Course Title	**Modern Communication Systems**			
Course Code	**MEC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Comprehend various digital modulation techniques.

CO2 Explain the concept of Multicarrier Modulation.

CO3 Analyze errors in system using optimum receivers and detectors.

CO4 Gives an introduction to the theory of stochastic processes.

CO5 Contribute in the areas of software defines radio and cognitive radio.

CO6 Understand MIMO systems and channel modeling.

Syllabus

Unit 1. Digital Communication Systems

Introduction to communications systems, digital communication systems, review of digital modulation techniques, PCM, BPSK, QPSK, GMSK, Delta Modulation, Adaptive Delta Modulation, Sigma Delta Modulation, Basic principles of orthogonality, Single vs Multicarrier Systems, OFDM block diagram and its Explanations, Shannon- Fano Coding, Huffman Coding, Hamming Coding.

Unit 2. Stochastic Process

Introduction, Mathematical definition of a stochastic process, Mean-Square Stochastic Integrals, Mean-Square Stochastic Differential Equations, Markov process, Poisson process, Ergodic Process.

Unit 3. Optimum Receivers

Optimum receivers for signals corrupted by additive white gaussian noise, Correlation demodulator, Optimum detector. ML sequence detector, Probability of error for binary modulation techniques.

Unit 4. Software Defined Radio

Need for software radio, general structure for transceiver for SDR, third generation SDR system architecture, trends in SDR, cognitive radio, spectrum sensing in cognitive radio.

Unit 5. MIMO Systems

Introduction, space diversity and systems based on space diversity, MIMO based system architecture, MIMO channel modeling, MIMO channel measurement, MIMO channel capacity.

Text Books:

1. U. Dalal, "Wireless Communication", Oxford University Press, fifth impression 2012.

2. H. Stark and J. Woods, "Probability, Statistics, and Random Processes for Engineers", 4th Edition, Pearson, 4e, 2012.

3. Taub and Schilling, "Principles of Communication Systems", 4e, Mc Graw Hills Education India 2014.

Reference books and other resources:

1. John G. Proakis, "Digital Communication", 5e, Mc Graw Hills Education, 2014.

2. W. Tomasi, "Advanced Communication Systems", Pearson Education.

3. S. Haykin "Digital Communication Systems", Wiley, 2013.

4. R. Bose, "Information Theory, Coding and Cryptography", Mc Graw Hills Education, 2008.

5. Related IEEE/IEE/ Science Direct publications.

Course Title	**VLSI Physical Design and Automation**			
Course Code	**MEC-102**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes:

On successful completion of this course, the students should be able to:

CO1 Describe the various steps involved in VLSI Design Cycle and discuss the basic algorithms of data structures.

CO2 Design the VLSI devices and explain their Fabrication process.

CO3 Understand the issues related to fabrication process, cost and power dissipation.

CO4 Analyze and apply different algorithms for Partitioning, Floorplanning and Placement.

CO5 Classify the various Routing Algorithms.

CO6 Explain the Clock and power routing in Physical Design.

Syllabus:

Unit 1. Introduction

VLSI Design Cycle, Physical Design Cycle, New Trends in Physical Design Cycle, Design Styles and System Packaging Styles, Introduction to EDA tools, Basic Data Structure and basic algorithm techniques.

Unit 2. Fabrication of VLSI Devices

Fabrication of VLSI Circuits: nMOS Fabrication Process, CMOS Fabrication Process, Details of Fabrication Process.

Unit 3. Fabrication Process and its impact on Physical Design

Scaling Methods, Comparison of fabrication process, Issues related to Fabrication Process and other issues in interconnect power dissipation, yield and fabrication costs.

Unit 4. Physical Design

Design Rules and Layout of basic devices, NP-hard problems, design style specific partitioning problems, Partitioning algorithms: Group migration algorithms, Floorplanning, floorplanning algorithms, floorplanning algorithms for mixed block and cell designs, Placement, Placement algorithms, Partitioning based Placement algorithms, Pin assignment, advanced heuristic soft computing techniques for Partitioning, Floorplanning and Placement.

Unit 5. Various Routing Techniques

Global Routing, Global Routing Algorithms, Detailed Routing, routing considerations, routing models, channel routing problems, switchbox routing problems, Detailed Routing Algorithms, Over –the- cell routing: cell models, Overview of Two, Three and multilayer layer over –the- cell routers and performance driven OTC routing, Clock and power routing: clocking schemes, design considerations for the clocking system, power and ground routing.

Text Books:

1. N. A. Sherwani, Algorithms for VLSI Physical Design Automation, Third Edition, Springer, 2013.

2. Neil H. E Weste, D. Harris and A. Banerjee, CMOS VLSI Design- A circuits and System perspective, Third Edition, Pearson Education, 2005

3. R. A. Hasting, The Art of Analog Layout, second Edition, Pearson Prentice Hall, 2006.

4. E. Brunvand, Digital VLSI Chip Design with Cadence and Synopsys CAD tools, Addison Wesley, 2010.

Reference Books and other resources:

1. M. Sarrafzadeh and C.K. Wong, Introduction to VLSI Physical Design, Fourth Edition, McGraw-Hill, 1996

2. Charles J. Alpert, Dinesh P. Mehta, Sachin S. Sapatnekar, Handbook of Algorithms for Physical Design Automation, Auerbach Publications (CRC Press), 2008.

3. R. Dreschler, Evolutionary Algorithms for VLSI CAD, Third Edition, Springer, 2002.

4. S.K. Lim, Practical Problems in VLSI Physical Design Automation, Springer, 2008.

5. S.M. Sait and H. Youssef, VLSI Physical Design Automation: Theory and Practice, World Scientific, 1999.

6. Pinaki Mazumder, Elizabeth M. Rudnick, Genetic Algorithms for VLSI Design, Layout & Test Automation Pearson Education., 1999

7. Dan Clein, CMOS IC Layout-Concepts, Methodologies and Tools, Technical contributors-Gregg Shimokura, 1958.

8. Bing Lu, Dhing-Zhu Du and Sachin S. Sapatnekar, Layout Optimization in VLSI Design, Kluwer Academic Publishers, Springer Science, 2001.

9. NPTEL MOOCS video courses.

10. Related IEEE Publications

Course Title	**Modelling and Simulation of Communication Systems**			
Course Code	**MEC-103**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 30-40%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes:

On successful completion of this course, the students should be able to:

CO1 Comprehend the concept of simulation and modeling of communication system.

CO2 Explain models involved in analog channels, digital channels and light wave systems.

CO3 Apply Random Process models on random variables.

CO4 Estimate performance metrics of analog and digital communication system.

CO5 Analyse Various Queuing models.

CO6 Analyse TDM, Polling and Random-access systems

Syllabus

Unit 1. Introduction

Concept of simulation and modeling, Roles of Simulation, Types of Simulation, Limits of Simulation, Simulation Languages (High Level versus Low Level), Real-time Simulation.

Unit 2. Modeling of Communication System

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bustry channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system Models.

Unit 3. Simulation of Random Variables and Random Process

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers.

Unit 4. Estimation of Performance Measures

Quality of an estimator, estimator of SNR, Probability density functions of analog communication system, BER of Digital communication systems, Monte Carlo method and Importance sampling method, estimation of power, Spectral density of a process.

Unit 5. Queuing Models

Characteristics of Queuing models, Queuing notation, Long Run Performance measures of Queuing Systems, Steady state behavior of M/M/I and M/M/I/N queuing models, little

formula, Burke's theorem M/G/I queuing Model, Embedded Markov Chain analysis of TDM systems, Polling, Random access systems.

Text Books:

1. M. C. Jeruchim, Philip Balaban and K. Sam Shanmugam, "Simulation of communication systems", Plenum Press, New York, 1992.

2. M.Law and W. David Kelton, "Simulation Modelling and analysis", Tata McGraw

Hill, New York, 2008.

Reference books and other resources:

1. M.C. Jeruchim, Philip Balaban and K. Sam shanmugam, Simulation of communication systems: Modeling, Methodology and Techniques, Kluwer academic/Plenum press, New York, 2000.

2. K. C. Raveendranathan, "Communication Systems Modelling and Simulation Using MATLAB and Simulink", Universities Press, 2011.

Course Title	**Semiconductor Devices Theory and Modelling**			
Course Code	**MEC-104**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Apply basic equations like Poisson's equations, continuity equation etc. for the operation of semiconductor devices.

CO2 Explain the current-voltage characteristics and switching characteristics of p-n junctions with the use of mathematical equations.

CO3 Model low frequency capacitance-voltage characteristics and other depletion effects on device performance.

CO4 Discuss high frequency capacitance-voltage features.

CO5 Derive bipolar device models for circuit and time-dependent analysis.

CO6 Differentiate between long-channel and short-channel MOSFETs on the basis of characteristics and non-linear parameters.

Syllabus

Unit 1. Physics of Semiconductors

Energy bands in solids- carrier concentration in intrinsic and extrinsic semiconductors, Carrier transport in silicon-drift and diffusion current, velocity saturation, Basic equations for device operation-Poisson's equation, current-density equations, continuity equation.

Unit 2. P-N Junctions

Built-in potential, Diode equation, current-voltage characteristics-temperature dependence and diode leakage currents, Time-dependent and switching characteristics-excess charge carriers, Diffusion Capacitance.

Unit 3. Bipolar Transistors

NPN & PNP Transistors, Ideal Current-Voltage Characteristics, Bipolar Device Models for Circuit and Time-Dependent Analysis.

Unit 4. MOS capacitors

Surface Potential, electrostatic Potential and charge distribution in Silicon, Capacitances in MOS structure-low frequency and high frequency C-V characteristics, polysilicon work function and depletion effects, charge in Si-SiO2 interface, effects of interface traps on device characteristics-surface generation and recombination.

Unit 5. MOSFET Devices

Long-channel MOSFETs: drain current model, I-V characteristics, subthreshold characteristics, Temperature dependence of Threshold voltage, channel mobility. Short-Channel MOSFETs: short channel effects, velocity saturation, channel length modulation, source-drain series resistance.

Text Books:

1. Y. Taur and T. H. Ning, "Fundamentals of Modern VLSI Devices", Second Edition, Cambridge University Press, 2013.

2. N. Arora, "MOSFET Modeling for VLSI simulation: Theory and Practice", World Scientific, 2007.

Reference books and other resources:

1. S. M. Sze, "Physics of Semiconductor Devices", John Wiley & Sons, 3rd Edition, 2007.

2. B. G. Streetman and S. Banerjee, "Solid State Electronic Devices", Pearson Prentice Hall, 2006.

3. T. A. Fjeldly, T. Ytterdal and M. S. Shur, "Introduction to Device Modeling and Circuit Simulation", Wiley.

4. Y. Tsividis, "Operation and Modeling of the MOS Transistor", Second Edition, Oxford.

5. R. F. Pierret, "Semiconductor Device Fundamentals", Addison Wesley Publishers, 1996.

Course Title	**Soft Computing**			
Course Code	**MEC-105**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20 %

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Differentiate Biological and Artificial Neural Networks.

CO2 Explain the concepts of fuzzy logic, soft computing, artificial intelligence and optimization problems.

CO3 Explain the principles of Artificial Neural Networks and design Artificial Neural Networks models for given problems.

CO4 Utilize the Genetic Algorithms and PSO Algorithm for the optimization of given problems.

CO5 Understand the architecture of various Learning Algorithms.

CO6 Design hybrid soft computing algorithms for solving the different problems.

Syllabus

Unit 1. Soft Computing and Artificial Intelligence

Hard vs. Soft computing, constituents of soft computing, scope of soft computing, meaning of optimization, local optima, global optima, heuristic methods, stochastic methods, constrained optimization, design variables, objective function, and variable bounds. Artificial intelligence: definitions, programming models and techniques, fundamental issues, progress of artificial intelligence.

Unit 2. Artificial Neural Networks

Biological neural networks, history of development in neural networks principles, artificial neural net terminology, models of neuron, activation functions, topology, learning, types of learning: supervised, unsupervised, Re-enforcements learning, learning Rules/Methods. Back-propagation learning algorithm, architecture of back propagation networks, selection of various parameters in back propagation networks.

Unit 3. Genetic Algorithm (GA)

GA history, biological background of GA, working principle, basic terminologies, operators: encoding, selection, cross over, mutation, stopping criteria, problem solving using GA.

Unit 4. PSO Algorithm

Biological background of PSO, working principle, basic terminologies, operators, PSO equations, problem solving using PSO.

Unit 5. Fuzzy Logic and Hybrid Soft Computing Techniques

Introduction to fuzzy logic, Crisp & fuzzy sets; properties, operations, and relations, membership functions, Neuro-fuzzy hybrid algorithm, genetic neuro-hybrid algorithm, fuzzy genetic-hybrid algorithm, genetic fuzzy hybrid algorithm, GA-PSO hybrid algorithm.

Text Books:

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, 2010.

2. F. O. Karry and C. D. Silva, "Soft Computing and Intelligent Systems Design", Pearson Education, 2009.

Reference books and other resources:

1. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", Second Edition, Wiley Publications, 2007.

2. J.-S R. Jang, C.-T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", Prentice Hall India, 2010.

3. S. K. Valluru and T. N. Rao, "Introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms", First Edition, Jaico, 2010.

4. N. P. Padhy, "Artificial Intelligence and Intelligent Systems", Second Edition, Oxford University Press, 2005.

5. Related IEEE/IEE/ Science Direct publications.

Course Title	**Antennas and Radiating Systems**			
Course Code	**MEC-106**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

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

CO1 Comprehend basic parameters of antenna

CO2 Describe and analyses microstrip antennas

CO3 Explain and use various feeding techniques

CO4 Explain the radiation mechanism in various wire and aperture antennas

CO5 Develop antennas and measure various parameters like Gain, Directivity, VSWR etc.

CO6 Design different UWB antennas

Syllabus

Unit 1. Introduction to Antennas

Antenna fundamentals, Basic parameters of antenna, Types of antennas: Biconical antenna, discone& conical skirt monopole, equiangular spiral antenna, fractal antenna concept & technology, corrugated horn antenna, multimode horn antenna, smart antenna- benefit, drawbacks & design, Electrically small & big antenna, electrically & physically small antenna, ground plane antenna, sleeve antenna, turnstile antenna, surface wave & leaky wave antenna, embedded antenna, plasma antenna.

Unit 2. Microstrip Antennas

Radiation mechanism of microstrip antennas, printed dipole antenna, printed slot antennas, feeding techniques and modelling (Co-axial, Inset, Aperture/Slot Coupled, Proximity coupled), surface waves and photonic bandgap structures

Unit 3. Microstrip Antenna Analysis

Models for rectangular patch antennas: Transmission line model analysis, Cavity model analysis, Design considerations of rectangular patch antennas, Circularly polarized Microstrip Antennas, Broadband Microstrip Antennas.

Unit 4. Radiating Systems

Radiation from Apertures: Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas

Unit 6. Ultra-Wideband Antennas

Omni-directional UWB antenna, Directional UWB antenna, Band-notched UWB antenna, printed wide slot UWB antenna, UWB antennas for wireless applications.

Text Books:

1. C. A. Balanis, "Antenna Theory and Design", 3rd Ed., John Wiley & Sons., 2005.

2. R. Garg, P. Bhartia, I. Bahl and A. Ittipiboon, “Microstrip antenna design handbook”, Artech house, London, 2001.

Reference Books:

1. R. E. Collin, "Antennas and Radio Wave Propagation", McGraw-Hill., 1985.

2. F. B. Gross, "Smart Antennas for Wireless Communications", McGraw-Hill., 2005.

3. W. L. Stutzman, and G. A. Thiele, "Antenna Theory and Design", 2nd Ed., John Wiley & Sons., 1998.

4. R. S. Elliot, "Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003.

Course Title	**Computer Communication and Network Security**			
Course Code	**MEC-107**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10-20%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Describe communication protocols and their operation.

CO2 Explain different layers of TCP/IP Protocol suite

CO3 Design solutions for routing issues in the network.

CO4 Requisite of security in modern communication systems.

CO5 Discuss the terminology used in cryptology domain.

CO6 Design the various cryptographic protocols.

Syllabus

Unit 1. Network Protocols

Review of Data Communication and Networking, OSI and TCP/IP Protocol Suite, Error Control, Flow Control, Bit Oriented and Character Oriented Protocol, Data Link Layer Services, X.25, Virtual Circuits and Datagram's, CSMA/CD, Comparison of IPv4 and IPv6

Unit 2. Network Layer Protocols

The optimality principle, Sink tree formation, Shortest path routing and solution of network problems using Dijkstra's Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks.

Unit 3: Network Security

Network and computer security issues, Security attacks. A model of network security, Introduction to Cryptology, Cryptography and its objectives, Cryptanalysis, Classifications of cryptography; Concept of symmetric and asymmetric cryptography, Stream Ciphers versus Block Ciphers, Substitution and Transposition techniques, Steganography.

Unit 4: Private and Public key cryptosystems

Block cipher principles, Study of DES Algorithm, its internal structure, f-function and its key schedule, Triple DES, IDEA and Blowfish algorithm, AES Structure and its round function and key expansion. Principles of asymmetric protocols, RSA algorithm, Distribution of public keys, Diffie-Hellman key exchange.

Text Books:

1. W. Stallings, “Data and Computer Communication”, Sixth Edition, Prentice Hall, 2002.

2. William Stallings, “Cryptography and Network Security”, 5e, Prentice Hall, 2011

Reference books and other resources:

1. A. S. Tanenbaum, “Computer Networks”, Fourth Edition, Pearson Education, 2011.

2. B. A. Forouzan, “Data Communications and Networking”, Third Edition, Tata McGraw-Hill, 2004.

3. S. Keshav, “An Engineering Approach to Computer Networking: ATM Networks, The Internet and the Telephone Network”, First Edition, Pearson Education, 1987.

4. D. P. Bertsekas, “Data Networks”, Second Edition, Prentice Hall, 1992.

5. J. F. Hayes, “Modelling and Analysis of Computer Communication Networks”, First Edition, Springer, 1984.

6. B. Schneier, “Applied Cryptography”, 2e, John Wiley & Sons, 1996

7. W. Zeng, H. Yu and C. Lin, “Multimedia Security Technologies for Digital Rights Management”, Elsevier, 2006

8. B. Furht and D. Kirovski, “Multimedia Security Handbook”, CRC Press, 2005

Course Title	**Advanced Embedded System Design**			
Course Code	**MEC-108**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Classify and illustrate the use of Embedded Systems.

CO2 Explain the architecture and programmer's model of ARM microcontrollers.

CO3 Apply the knowledge of ARM7.

CO4 Describe the embedded networking concepts.

CO5 Comprehend Real-Time Embedded System concepts.

CO6 Develop applications based on Embedded System hardware and software.

Syllabus

Unit 1. Review of Embedded Systems

Overview of embedded systems, Embedded processors in systems, Embedded hardware units and devices, Design process in embedded systems, Classification of embedded systems, Real life examples.

Unit 2. ARM 32-Bit Microcontroller Architecture

Architecture, Registers, Pipeline, Interrupts and the vector table, Architecture revisions, ARM processor families.

Unit 3. ARM Instruction Set

Instruction Set: Data processing instructions, Branch instructions, Load-store instructions, Software interrupt instruction, Program status register instructions, Conditional execution.

Unit 4. Networked Embedded Systems

Serial bus communication protocols: I 2 C Bus, CAN Bus, USB Bus; Parallel Bus Communication Protocols: ISA, PCI and advanced buses; Internet Enabled Systems; Wireless and Mobile System Protocols, applications in the areas of connected vehicles and disaster management.

Unit 5. Design Examples Using ARM7

ARM7 I/O Port Description, Interfacing Programs for UART, Timer, ADC and DAC.

Unit 6. Real-Time Embedded Systems Software

Real-time Embedded Systems, Real-Time Operating Systems (RTOS)– Key characteristics, The Scheduler, Tasks, Semaphores, Message Queues, Basic design using RTOS.

Text Books:

1. R. Kamal, "Embedded Systems, Architecture Programming and Design", Second Edition, Tata McGraw Hill, 2008.
2. N. Sloss, D. Symes, C. Wright and J. Rayfield, "ARM System Developer's Guide, Designing and Optimizing System Software", Elsevier, 2004.

Reference books and other resources:

1. T. Martin, "The Insider's Guide to The Philips ARM7-Based Microcontrollers, An Engineer's Introduction to The LPC2100 Series", Hitex, 2005.
2. Q. Li, "Real Time Concepts for Embedded Systems", CMP Books, 2003.
3. UM10139 LPC214x User manual.
4. Website: www.arm.com.

Course Title	**Modern Communication Systems – Lab**			
Course Code	**LMEC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**50**	**0**	**0**	**4**

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Apply the knowledge of various simulation software.

CO2 Analyze various types of modulation techniques and associated parameters on MATLAB tool

CO3 Implement various diversity techniques and measure their performance parameters.

CO4 Design and simulate antenna model in IE3D software.

CO5 Analyze the spectrum sensing techniques in cognitive radio.

CO6 Design and simulate the MIMO system on software tool.

List of Experiments

1. To simulate PCM using MATLAB software.
2. To simulate Binary Phase shift keying technique using MATLAB software.
3. To simulate GMSK technique using MATLAB software
4. To simulate Delta modulation technique using MATLAB software.
5. To simulate Adaptive Delta modulation technique using MATLAB software.
6. To simulate Sigma Delta modulation technique using MATLAB software.
7. To calculate Probability of error for binary modulation techniques using MATLAB software.
8. Introduction to antenna design using IE3D software.
9. To simulate and analyze a simple rectangular micro strip antenna of L=20mm and W=10mm. Assume the value of dielectric constant=2.2 and substrate thickness of 1.585 mm.
10. To set up a transmission and reception link using GNU and SDR kits.
11. To perform spectrum sensing in cognitive radio using MATLAB software.
12. To simulate Transmit diversity and receive diversity in MATLAB.

References:

1. Lab Manuals of MATLAB and IE3D Software.

2. Lab Manuals of GNU and SDR kits

Course Title	**VLSI Physical Design and Automation – Lab**			
Course Code	**LMEC-102**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**50**	**0**	**0**	**4**

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Implement logic gates, combinational and Sequential Circuits in Xilinx tool.

CO2 Design, analyze and simulate MOS devices in Cadence environment.

CO3 Learn and Implement various Partitioning and Floor planning algorithms using MATLAB.

CO4 Understand and implement advanced Placement algorithms.

CO5 Describe and implement routing-based algorithm in VLSI design.

CO6 Implement evolutionary of Algorithms in VLSI design cycle.

List of Experiments

1. Study of simulation and FPGA implementation of Xilinx tool
2. Design & FPGA Implementation of Logic Gates, Combinational and Sequential Circuits.
3. Design, simulation & Layout Extraction of CMOS Inverter using Cadence tool.
4. Design, simulation & Layout Extraction of CMOS NOR and CMOS NAND circuits using Cadence tool.
5. Design, simulation & Layout Extraction of 6T SRAM cell using Cadence tool.
6. Design, simulation & Layout Extraction of Common source amplifier using Cadence tool.
7. Implement and Study of constraints related to Kernighan-Lin (KL), Fiduccia – Mattheyses (FM) and extension of FM Algorithms on concept of Partitioning in MATLAB software.
8. Implement and Compare constraint based, integer programming, rectangular dualization and Hierarchical tree-based algorithms on Floorplanning using MATLAB software.
9. Implement partitioning-based Placement Algorithms (a) Breuer's Algorithm (b) Terminal Propagation Algorithm in MATLAB software.
10. Implement Maze routing, shortest path based and steiner tree based Global routing algorithms in MATLAB.
11. Implement single layer and Multilayer Detailed Routing Algorithms in MATLAB software.

12. Study and Implementation of Algorithms like GA, PSO on Partitioning, Placement, Floor planning. Pin Assignment and routing techniques.

References:

1. Lab Manual of Xilinx tool
2. Lab Manuals of Cadence and MATLAB Software.

Course Title	**Research Methodology and IPR**			
Course Code	**MRM-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 0-10%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

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

CO1 Understand research problem formulation.

CO2 Analyze research related information.

CO3 Follow research ethics.

CO4 Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO5 Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO6 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.

Syllabus

Unit 1. 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 2. Effective literature studies approach, analysis Plagiarism, Research ethics.

Unit 3. 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 4. 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 5. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6. 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.

Text Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide• for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.

Reference books and other resources:

1. Niebel, "Product Design", McGraw Hill, 1974.
2. Asimov, "Introduction to Design", Prentice Hall, 1962.
3. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
4. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Course Title	**Advanced Digital Signal Processing**			
Course Code	**MEC-109**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Design FIR filters using appropriate method depending upon the given specification.

CO2 Design IIR filters and study its various features.

CO3 Explain sampling rate conversion methods and design the sampling rate converters.

CO4 Adaptive filters design using LMS & RLS algorithms.

CO5 Analyse the effects of finite-word length in DSP systems.

CO6 Explain applications of multi-rate DSP & adaptive filters.

Syllabus

Unit 1. Design of IIR Filters

Introduction to digital filters; Types of digital filters: FIR and IIR filters; Choosing between FIR and IIR filters; Filter design steps; Features of IIR filters; coefficient calculation methods for IIR filters; Pole-zero placement method of coefficient calculation, Impulse invariant method of coefficient calculation, Matched z-transform (MZT) method of coefficient calculation, Bilinear z-transform (BZT) method of coefficient calculation.

Unit 2. Design of FIR Filters

Features of FIR Filters; FIR coefficient calculation methods; Window methods; The Optimal method; Frequency sampling method; Special FIR Filter design topics.

Unit 3. Multirate Digital Signal Processing

Introduction; Concepts of multirate signal processing: Sampling rate reduction: decimation by integer factors, Sampling rate increase: interpolation by integer factors, Sampling rate conversion by non-integer factors, Multistage approach to sampling rate conversion; Design of practical sampling rate converters; Sample rate conversion using polyphase filter structure; Applications of multirate signal processing.

Unit 4. Adaptive Digital Filters

Concepts of adaptive filtering, Basic Wiener filter theory, Basic LMS adaptive algorithm, Recursive least squares algorithm, Applications of adaptive filters.

Unit 5. Analysis of Finite Word-length Effects in Fixed-Point DSP Systems

DSP arithmetic: Fixed-point arithmetic, Floating-point arithmetic, ADC quantization noise and signal quality, Finite word length effects in IIR and FIR digital filters.

Text Books:

1. E. C. Ifeachor and B. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education, 2002.
2. J. G. Proakis and D. K. Manolakis, "Digital Signal Processing", Third Edition, Pearson Education, 2003.

Reference books and other resources:

1. J. G. Proakis, C. M. Rader, F. Ling, C. L. Nikias, M. Moonen, and I. K. Proudler, "Algorithms for Statistical Signal Processing", Pearson Education, 2002.
2. A. V. Oppenheim and R. W. Schafer, "Digital Signal Processing", Prentice Hall, 1975.
3. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", Wiley Publications, 1999.
4. S. Haykin, "Adaptive Filter Theory", Fourth Edition, Pearson Education, 2008.

Course Title	**Advanced Optical Communication Systems**			
Course Code	**MEC-110**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30 %

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Analyse the various signal propagation concepts (including losses, dispersion, scattering, nonlinear effects etc.) related to optical fibers.

CO2 Determine the structure design of different optical devices and sensors.

CO3 Understand the concepts related to different dispersion management techniques used in optical fiber communication.

CO4 Define the soliton system and analyse the design of soliton system in different conditions (loss, dispersion, high speed and multichannel).

CO5 Analyse the modulation formats and demodulation schemes used in coherent light wave systems and analyse their performance.

CO6 Describe basic concepts related to various optical networks.

Syllabus

Unit 1. Introduction to Optical Fibers

Wave propagation, Dispersion and its limitations, losses and non-linear effects.

Unit 2. Optical Amplifiers

Optical couplers, optical multiplexers, optical demultiplexers, Arrayed Waveguide gratings, optical circulators, attenuators, EDFA , SOA, pyrometer, proximity detector.

Unit 3. Dispersion Management

Need pre-compensation schemes, best compensation techniques, dispersion compensating fibers, optical filters, fiber Bragg grating

Unit 4. Soliton Systems

Fiber soliton, Soliton based communications, loss managed solitons, dispersion-managed solitons, high speed soliton systems, WDM soliton systems.

Unit 5. Coherent Light Wave Systems

Basic concepts, modulation formats, demodulation schemes, bit error rate, sensitivity degradation.

Unit 6. Optical Networks

SONET/SDH, optical interfaces, Passive optical network, Wavelength routed networks, Radio over fiber, Li-Fi.

Text Books:

1. G. P. Aggarwal, "Fiber-Optic Communication Systems", John Wiley & Sons, 4th Edition, 2018
2. Gerd Keiser, "Optical Fiber Communication", MGH, 4th Edition, 2008.

Reference books and other resources:

1. Djafar K. Mynbaev, "Fiber-Optic Communication Systems", Prentice Hall, 1st Edition, 2000.
2. John M. Senior, "Optical Fiber Communication Systems", Pearson Education, 3rd edition, 2007.
3. Hamed Al-Raweshidy and Shozo Komaki, "Radio Over Fiber Technologies for Mobile Communication Networks", Artech House, 1st Edition, 2002.
4. Related IEEE/IEE publications.

Course Title	**Advanced Digital System Design**			
Course Code	**MEC-111**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 30-40%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes:

On successful completion of this course, the students should be able to:

CO1 Apply the knowledge of digital design method to design standard combinational circuits and its use in implementation of other digital circuit.

CO2 Explain the standard design methods of synchronous sequential machines and apply this knowledge in designing of synchronous sequential machines.

CO3 Demonstrate the ability to analyze and design the multi-input system controllers.

CO4 Develop the ability to understand the role of standard combinational circuits in the designing of multi-input system controllers.

CO5 Extend and apply the acquired knowledge to analyze and design of asynchronous sequential machines.

CO6 Develop VHDL code for various combinational and sequential circuits.

Syllabus

Unit 1. Review of digital electronics concept

Design and analysis of combinational circuits (Arithmetic Circuits, Comparators, Multiplexers, Code Converters) and sequential machines (State Diagram, Design Steps for Traditional Synchronous Sequential Circuits, Counters, Shift Registers and Memory)

Unit 2. Multi Input System Controller Design

System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

Unit 3. Asynchronous Finite State Machines

Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility

Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, co-axial cable etc.

Unit 4. Digital Logic Design with VHDL

Combinational Logic Design-complex Logic Gates, Half Adder, multiplexer, encoder, Seven-segment display driver, Sequential Logic Design-Latches and Flip-Flops, counter design

Text Books:

1. An Engineering Approach to Digital Design - Fletcher PHI, 1990

Reference books and other resources:

1. Designing with TTL Circuits - Texas Instruments.

2. Engineering Digital Design, 2nd ed, Academic Press-by Richard F Tinder

3. Digital Design- principles and practices, 3rd edition, Pearson Education Asia-by John F Wakerly

4. Digital Logic and State Machine Design, 3rd edition, Oxford University Press- David J Comer,

5. Fundamentals of Digital Logic with VHDL design – Stephen Brown, Zvonko Vranesic – TMH.

6. Digital Systems design with FPGAs and CPLDs, Newnes (Elsevier)-by Ian Grout

7. Related IEEE/IEE publications

Course Title	**Advanced Wireless and Mobile Communication**			
Course Code	**MEC-112**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Comprehend the basic terminology and various generations of wireless communication systems.

CO2 Discuss various types of fading techniques and associated parameters.

CO3 Explain various types of Diversity Techniques.

CO4 Illustrate various techniques to combat fading.

CO5 Describe multiple accesses using CDMA.

CO6 Discuss latest Wireless communication standards and Advanced wireless technologies.

Syllabus

Unit 1. Review of Wireless Communication Systems

The cellular concept, handoff and system capacity, trunking and grade of service, capacity improvement techniques, Evolution and enabling technologies of cellular networks: 2G, 2.5 G, 3G-WCDMA, 3G CDMA 2000, 3G TD-SCDMA

Unit 2. Small Scale Fading and Multipath

Wireless channel and fading, types of fading, Parameters of mobile multipath channels, ISI and its reduction using Pulse shaping techniques, Rayleigh fading, Rician fading and Nakagami fading distributions.

Unit 3. Diversity and Channel equalization

Introduction to diversity, types of diversity, multi antenna maximal ratio combiner, BER with diversity, fundamentals of equalization, algorithms for adaptive equalization.

Unit 4. Multiple Access

Introduction to CDMA, spread spectrum and linear feedback shift register, generation and properties of PN sequences, correlation of PN sequences and jammer margin, CDMA advantage and RAKE Receiver, Multi user CDMA.

Unit 5. Latest Wireless Standards

IEEE 802.15.6 Body area network, IEEE 802.20 Mobile Broadband Wireless Access, IEEE 802.22 Wireless Regional Area Networks, evolving IEEE 802.25 Omni-Range Area Network.

Unit 6. Advanced Wireless Technologies

Introduction to 4G(3GPP-LTE), Concept of V-blast and H-blast, 5G Multiple and medium access schemes-Orthogonal multiple-access systems, Spread spectrum multiple-access systems, Non-orthogonal multiple access (NOMA), Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), 5G functional Architecture

Text Books:

1. Afif Ossetran, "5G Mobile and Wireless Communications Technologies", Cambridge press, 2016.

2. T. S. Rappaport, “Wireless Communications”, Pearson Education.

3. William Stallings, “Wireless Communication and Networks”, Pearson Prentice Hall.

Reference books and other resources:

1. NPTEL, “Advanced 3G and 4G Wireless Mobile Communications”, http://nptel.ac.in/courses/117104099/.

2. Jochen Schiller, “Mobile Communications”, 2nd Edition, Addison-Wesley.

3. Research Papers from IEEE Journals.

Course Title	**Engineering Design and Project Management**			
Course Code	**MEC-113**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 5%-10 %

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Develop ability to analyze and solve problems methodically as well as manage individual and team projects with appropriate consideration of engineering and financial aspects.

CO2 Have an understanding of professional, ethical and social responsibilities as professional Engineer and manager.

CO3 Comprehend how to select and plan a project.

CO4 Discuss the characteristics of Project Management.

CO5 Develop an ability to communicate effectively through oral and written presentation.

CO6 Perform effectively in groups and teams as a member / leader.

Syllabus

Unit 1. Introduction to Engineering Design

Definition, identifying requirements & analyzing needs, Exploring and evaluating concepts, Prototyping and modeling systems, Testing, Deploying and validating a design, Documentation.

Unit 2. Introduction to Project Management

Definition of a project, why project management, Project life cycle, Organization structures (functional vs. matrix and borrowed resources), Translating needs into requirements, Survey of local & global industrial economic scenario.

Unit 3. Project Selection and Planning

Project selection approaches, Decision methodologies (decision trees, analytical hierarchy process), Project evaluation techniques, Estimation (costs, schedule and requirements), Project financing.

Unit 4. Project Management and Leadership

Special demands on project managers, selecting the project manager and the project team, Project communications, Teams and team development, Characteristics of successful project management.

Unit 5. Project Planning and Estimating

Work breakdown structure, Scheduling techniques (precedence diagrams, PERT/CPM, Gantt and milestone charts), Budgeting techniques (S-curve, earned value) Resource allocation techniques (resource loading and levelling)

Unit 6. Risk and Quality Management

Fundaments of risk (e.g., what is risk?), Methods for dealing with risk and uncertainly, Historic roots of quality management, Current approaches to quality

Unit 7. Project Execution and Control

Project execution (configuration management), Project control (measuring work performance), Financial control (activity-based accounting), Integrated cost and schedule control (Earned value).

Unit 8. Ethical Project Management

Professional ethics & values, Corporate social Responsibility, Dealing within an ethical selection, Group case study & task.

Text Books:

1. K. Nagarajan, "Project Management, New Age International Publishers", New Delhi.

Reference books and other resources:

1. Kathy Schwalbe, "An Introduction to Project Management", Kathy Schwalbe LLC.

2. Paromeshwar P. Iyer, "Engineering Project Management with case studies", Vikas Publishing House Pvt. Limited, New Delhi.

3. B. Blanchard and W. Fabrycky, "Systems Engineering and Analysis", Prentice Hall.

Course Title	**Advanced Microwave Engineering**			
Course Code	**MEC-114**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Analyze microwave networks using S and mixed mode S parameters

CO2 Design microwave filters using various methods

CO3 Design advanced microwave amplifiers based on MIC

CO4 Explain the concept of microwave integrated circuits

CO5 Understand the concept of Microwave Non-linearities.

CO6 Apply the knowledge of compensation techniques.

Syllabus

Unit 1. Basics of Microwave Engineering

Microwave Network Analysis Concept of differential signal, coupling and crosstalk, Introduction to S parameters, properties of S parameters, Single ended, mixed mode, Single ended to mixed mode conversion.

Unit 2. Microwave Filters

Design of Microwave filters Introduction, Microwave filter structures, Planar, Active, Superconductive, SAW and micro-machined filters etc., Pseudo-elliptic Filters, Prototype Synthesis Example, Design of Hilbert Filters, Realizations and Measured Performance.

Unit 3. Low Noise Amplifier in Microwave

Advanced Microwave Integrated Circuits Multi-Standard Multi-Band Reconfigurable LNA, LNA Inventions, Multiband Multi-Standard LNA with CPW Transmission Line Inductor.

Unit 4. RF Design

General considerations, Effects of Nonlinearity, Noise, Sensitivity and Dynamic Range, Passive Impedance Transformation, Scattering Parameters, Analysis of Nonlinear Dynamic Systems.

Unit 5. Microwave Non Linearities

Non-linear devices, amplitude non linearity, phase non linearity, test methods, compensation techniques

Text Books:

1. Allan Huynh, Magnus Karlsson and Shaofang Gong, “Advanced Microwave Circuits and Systems”, In Tech 2010.

2. Pierre Jarry and Jacques Beneat, “Design and Realizations of Miniaturized Fractal Microwave and RF Filters”, Wiley-Blackwell 2009.

3. Arjuna Marzuki, Ahmad Ismat Abdul Rahim and Mourad Loulou, “Advances in Monolithic Microwave Integrated Circuits for Wireless Systems: Modeling and Design Technologies”, Information Science Reference 2012.

4. Behzad Razavi, RF Microelectronics, Second edition, Pearson.

Reference books and other resources:

1. David M. Pozar, Microwave Engineering, Fourth Edition, Wiley.

2. R.E. Collin, Foundations of Microwave Engineering,

3. Related IEEE publications

Course Title	**Internet of Things**			
Course Code	**MEC-115**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20 %

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Understand what IoT technologies are used for today, and what is required in certain scenarios.

CO2 Describe the architecture of various protocols in IoT communication.

CO3 Discuss the security and privacy concerns in FOG.

CO4 Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.

CO5 Describe the fundamentals of big data for IoT applications.

CO6 Apply these technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.

Syllabus

Unit 1: Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

Unit 2: Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

Unit 3: Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client-side control and configuration.

Unit 4: Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, Multithreading concepts in C Programming.

Unit 5: Operating systems requirement of IoT environment, study of mbed, RIoT, and Contiki operating systems, Introductory concepts of big data for IoT applications.

Unit 6: Applications of IoT, connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

Text Books:

1. A Bahaga, V. Madisetti, “Internet of Things- Hands on approach”, VPT publisher, 2014.

2. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.

3. CunoPfister, “Getting started with Internet of Things”, Maker Media, 1st edition, 2011.

4. Samuel Greenguard, “Internet of things”, MIT Press, 2015.

Web resources:

1. Open Source Tools for the Internet of Things, Retrieved from http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html

2. AnalogIn, Retrieved from https://developer.mbed.org/handbook/AnalogIn

3. Sensor applications for a Smarter World, Retrieved from http://www.libelium.com/50_sensor_applications/

Course Title	**Biomedical Electronics**			
Course Code	**MEC-116**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**100**	**3**	**0**	**0**

Numerical & Design Problems Content: 0-10%

Note: The question paper shall consist of eight questions of twenty (20) marks each, out of which five questions are required to be attempted by the candidate.

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Describe the methods of recording.

CO2 Discuss various techniques to measure bio potentials.

CO3 Analyze medical imaging systems.

CO4 Understand the knowledge of Ultrasonic systems.

CO5 Classify and describe therapeutic equipment's.

CO6 Discuss various Laser applications in Biomedical field.

Syllabus

Unit 1. Measuring, Recording and Monitoring Instruments

Biomedical signals and electrodes, Biomedical recorders, Oximeters, Biomedical telemetry, Telemedicine technology, Blood cell counters.

Unit 2. Modern Imaging Systems

X-ray machine, Visualization of X-rays, Physical parameters for X-ray Detectors, Principle of NMR Imaging system, Image reconstruction techniques, Basic NMR components, Biological effect of NMR imaging, Advantages of NMR imaging system.

Unit 3. Ultrasonic Systems

Basics of diagnostic radiology, Diagnostic Ultrasound, Physics of Ultrasonic waves, Medical ultrasound, Three-dimensional ultrasound imaging systems, Portable ultrasound systems.

Unit 4. Therapeutic Equipment

Cardiac pacemakers, Cardiac defibrillators, Electrotherapy equipment, Capnography, Radiotherapy equipment, Laser applications in Biomedical field.

Text Book:

1. R. S. Khandpur, "Magnetic Resonance Imaging System", in Handbook of Biomedical Instrumentation, Third Edition, New Delhi, India: McGraw Hill Education, 2014.

Reference books and other resources:

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment Technology”, John Wiley and Sons, New York, 2004.

2. Leislie Cromwell, “Biomedical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2007.

Course Title	**Advanced Digital Signal Processing – Lab**			
Course Code	**LMEC-103**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**50**	**0**	**0**	**4**

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Design IIR filters using different methods

CO2 Design FIR filters using different methods

CO3 To realize digital filters using different structures

CO4 To alter sampling rates by the given factor

CO5 Perform adaptive digital filtering using LMS/RLS algorithms

CO6 Apply DSP techniques to design practical systems e.g. echo cancellation of baseband signals

List of Experiments

1. Write a program for the design of Butterworth Low Pass digital filter for the given specifications.
2. Write a program for the design of Chebyshev Type-I Low Pass digital filter for the given specifications.
3. Write a program for transforming an analog filter into a digital filter using
   a. Impulse Invariant method
   b. Bilinear transformation approach
4. Write a program for the design of FIR low pass filter using
   a. Rectangular window
   b. Blackman Window
   c. Kaiser Window.

   Also compare the results obtained.
5. Write a program to determine the filter length and coefficients of optimal Low Pass filter for the given specifications.
6. Write a program for up sampling a sinusoidal signal by factor L.
7. Write a program for down sampling a sinusoidal signal by factor M.
8. Write a program for computing Parallel realization values of IIR digital filter.
9. Write a program for computing Cascade realization values of IIR digital filter.
10. Write a program for performing LMS based adaptive filtering.
11. Write a program for performing RLS based adaptive filtering.

12. Write a program for cancellation of echo produced on the telephone baseband channel.

References:

1. Lab Manual of MATLAB Software

Course Title	**Advanced Optical Communication Systems – Lab**			
Course Code	**LMEC-104**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**50**	**0**	**0**	**4**

Course Outcomes

On successful completion of this course, the students should be able to:

CO1 Apply the knowledge of various simulation software.

CO2 Implement fiber optic link and measure their performance parameters.

CO3 Design and simulate optical communication system models.

CO4 Analyze various types of modulation formats for optical communication system.

CO5 Design and simulate the opto-electronic circuits using OptiSPICE

CO6 Integrate different modules / components in the OCSim package.

List of Experiments

1. Introduction to OptiSystem simulation software.
2. Introduction to OptiSpice simulation software.
3. Introduction to OCSim simulation software.
4. To design fiber optic link and measure their performance parameters.
5. To design and simulate the external modulator transmitter.
6. To compare different parameters of optical communication system for various types of amplifiers.
7. To analyse different modulation formats for optical communication system.
8. To measure the dispersion parameter by varying length of optical fiber and mitigate it by compensation techniques.
9. To design and simulate the WDM system with 8 channels.
10. To combine the result of the Bit Error Rate, eye analyser with the signal input power using parameter sweeps.
11. Design and simulation of opto-electronic circuits using OptiSpice.
12. To integrate different modules / components in the OCSim package to realize fiber optic communication systems.

References:

1. Lab Manuals of OptiSystem, OptiSpice, and OC Sim software's

AUDIT COURSE – 1 & 2

Course Title	**English for Research Paper Writing**			
Course Code	**MAC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Understand that how to improve your writing skills and level of readability

CO2 Learn about what to write in each section

CO3 Understand the skills needed when writing a title ensure the good quality of paper at very first-time submission

CO4 Discuss the organisation of complete research paper

CO5 Useful skills needed for abstract writing, introduction and literature review of technical paper

CO6 Comprehend the skills desired for writing the discussion and conclusions in research paper

Syllabus

UNIT 1. Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT 2. Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT 3. Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT 4. Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT 5. Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT 6. Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

References:

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 .

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

Course Title	**Disaster Management**			
Course Code	**MAC-102**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO2 Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO3 Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO4 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

CO5 Awareness of various disaster prone area across country

CO6 Discuss structural, non-structural mitigation and various programmes related to them

Syllabus

Unit 1. Introduction

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit 2. Repercussions of Disasters and Hazards

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. 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 3. Disaster Prone Areas in India

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 4. 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 5. 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 and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit 6. 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.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ", New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep & Deep Publication Pvt. Ltd., New Delhi.

Course Title	**Sanskrit for Technical Knowledge**			
Course Code	**MAC-103**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Understand working knowledge in illustrious Sanskrit, the scientific language in the world

CO2 Understand Basic Sanskrit language and sentence formation

CO3 Comprehend Ancient Sanskrit literature about science & technology

CO4 Develop logic and understanding about language in students

CO5 Develop the logic in mathematics, science & other subjects enhancing the memory power

CO6 Explore the huge knowledge from ancient literature

Syllabus

Unit 1.

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

Unit 2.

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit 3.

- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

References:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Title	**Value Education**			
Course Code	**MAC-104**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Understand social values and work-ethics

CO2 Understand value of education and self- development

CO3 Learn the importance of Human values

CO4 Imbibe good values in students

CO5 Develop the overall personality

CO6 Know about the importance of character

Syllabus

Unit 1.

- 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 2.

- 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 3.

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labou
- 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 4.

- 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

References:

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

Course Title	**Constitution of India**			
Course Code	**MAC-105**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 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

CO2 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO3 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO4 Discuss the role and functioning of Election Commission

CO5 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.

CO6 Discuss the passage of the Hindu Code Bill of 1956.

Syllabus

Unit 1: History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

Unit 2: Philosophy of the Indian Constitution: Preamble Salient Features

Unit 3: 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 4: Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit 5: 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: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy

(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit 6: 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.

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.

Course Title	**Pedagogy Studies**			
Course Code	**MAC-106**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

CO2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

CO4 Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers

CO5 Identify critical evidence gaps to guide the development

CO6 Knowledge of curriculum and assessment in pedagogical education

Syllabus

Unit 1. 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 2. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education

Unit 3. Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, how can teacher education (curriculum and practicum) and the school 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 4. 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 5. Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact

References:

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. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Title	**Stress Management by Yoga**			
Course Code	**MAC-107**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Achieve overall health of body and mind

CO2 Overcome stress

CO3 Benefits of regularisation in breathing techniques

CO4 Learn importance of Yam and Niyam

CO5 Learn various types of yog

CO6 Study various types of pranayam

Syllabus:

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2: Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam i) Various yog poses and their benefits for mind & body ii) Regularization of breathing techniques and its Effects-Types of pranayam

References:

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

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Title	**Personality Development through life enlightenment skills**			
Course Code	**MAC-108**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes

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

CO1 Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

CO2 The person who has studied Geeta will lead the nation and mankind to peace and prosperity

CO3 Study of Neetishatakam will help in developing versatile personality of students

CO4 Learn to achieve the highest goal happily

CO5 Become a person with stable mind, pleasing personality and determination

CO6 Awaken wisdom in students

Syllabus

Unit 1. Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)

- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Unit 2.

- 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 3.

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

References:

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.