Course Structure and Syllabus

under

Choice Based Credit System (CBCS) Scheme

for

M. Sc. Programme in Electronics

(Academic Session 2019 and onwards)

P. G. Department of Electronics and Instrumentation Technology

University of Kashmir, Hazratbal, Srinagar-6, J&K

Programme Objectives

The rapid advances of the global information age are largely driven by innovations in modern electronics. Expertise in electronics plays a crucial role in giving economies, countries, and industries a competitive edge in the global market. This expertise underpins the development of new technologies, fuels economic growth, and enables industries to adapt to the everevolving demands of the digital era. By mastering electronics, nations can enhance their technological capabilities, leading to advancements in communications, automation, healthcare, and countless other sectors, thereby securing their position in the global economy. The M.Sc. Electronics Programme at the University of Kashmir, established in 1985, is a unique initiative aimed at fostering research and teaching across various domains of electronics. Unlike traditional engineering and engineering technology programs, this program is specifically designed to meet the distinct needs of the electronics industry in the country, with a strong emphasis on research and development. It offers a blend of theoretical knowledge and practical skills, tailored to equip students with the expertise required to drive innovation and technological advancements in the field of electronics. Engineering programs typically emphasize theory and conceptual design, while engineering technology programs focus more on application and implementation. The Electronic Science discipline is developed to bridge the gap between Science, Engineering, and Technology, offering a comprehensive approach that integrates both theoretical and practical aspects. The M.Sc. Electronics program is designed to meet the demand for skilled electronics professionals in the R&D sector of government organizations, as well as in teaching, and in both public and private sector units across the country. By combining rigorous scientific principles with practical engineering applications, this program prepares graduates to contribute effectively to the advancement of technology and innovation. This M.Sc. Electronics program offers a comprehensive understanding of contemporary electronics, equipping students with expertise in the design, simulation, and construction of electronic devices and systems. It also provides a flexible approach to studying electronics, allowing students to tailor the program to align with their specific interests. By offering a broad yet customizable curriculum, the program ensures that students can explore various areas of electronics while gaining the specialized skills needed to excel in their chosen fields.

Learning Objectives:

The learning objectives of an M.Sc. in Electronics are designed to equip students with a deep understanding of electronics and the skills needed to excel in various roles within the field. These objectives typically include:

1. Comprehensive Knowledge of Electronics

- ✓ **Theoretical Mastery:** Gain in-depth knowledge of key electronic principles, including analog and digital circuits, signal processing, microelectronics, and communication systems.
- ✓ **Specialization:** Develop expertise in specific areas such as embedded systems, VLSI design, or optoelectronics, tailored to the student’s interests and career goals.

2. Practical and Technical Proficiency

- ✓ **Design and Simulation:** Acquire skills in designing, simulating, and constructing electronic devices and systems using modern tools and techniques.
- ✓ **Laboratory Skills:** Enhance hands-on experience through extensive lab work, including the use of industry-standard software and equipment.

3. Research and Innovation

- ✓ **Research Skills:** Develop the ability to conduct independent research, including formulating research questions, designing experiments, and analyzing data.
- ✓ **Innovative Thinking:** Encourage creativity and innovation in addressing complex electronic challenges and developing new technologies.

4. Problem-Solving and Analytical Abilities

- ✓ **Critical Thinking:** Strengthen analytical skills for troubleshooting, optimizing, and improving electronic systems.
- ✓ **Systematic Approach:** Learn to approach problems systematically, integrating knowledge from various domains to find effective solutions.

5. Interdisciplinary Integration

- ✓ **Cross-Disciplinary Knowledge:** Integrate principles from related fields such as computer science, physics, and engineering to solve complex problems in electronics.
- ✓ **Systems Integration:** Understand the interactions between different electronic components and systems, promoting a holistic approach to electronic design.

6. Professional and Ethical Responsibility

- ✓ **Ethical Considerations:** Develop an awareness of the ethical implications of electronics, including issues related to privacy, security, and sustainability.
- ✓ **Professional Development:** Prepare for professional roles in electronics by understanding industry standards, project management, and effective communication.

7. Adaptability and Lifelong Learning

- ✓ **Continuous Learning:** Foster a commitment to lifelong learning, staying updated with the latest advancements in electronics and related technologies.
- ✓ **Adaptability:** Cultivate the ability to adapt to new tools, technologies, and methodologies in the rapidly evolving field of electronics.

8. Communication and Collaboration

- ✓ **Effective Communication:** Improve the ability to convey complex technical information clearly and effectively, both in writing and orally.
- ✓ **Teamwork:** Enhance collaboration skills, working effectively in teams to tackle interdisciplinary projects and research initiatives.

These objectives ensure that technocrats are well-prepared to contribute to the electronics industry, engage in cutting-edge research, and pursue advanced studies or careers in related fields.

Programme Outcomes

After completing the programme:

PO1. Engineering Knowledge: The students shall be able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve complex engineering problems.

PO2. Problem Analysis: The students shall be able to identify, formulate, review research literature, and analyze complex engineering problems, reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/Development of Solutions: The students shall be able to design solutions for engineering problems & design system components or processes that meet the specified needs with appropriate consideration for public health, safety, and cultural, societal, and environmental considerations.

PO4. Conduct Investigation of Complex Problems: The students shall be able to use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: The students shall be able to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: The students shall be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: The students shall be able to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO8. Ethics: The students shall be able to apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.

PO9. Individual and Teamwork: The students shall be able to function effectively as an individual, member, or leader in diverse teams and multidisciplinary settings.

PO10. Communication: The students shall be able to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: The students shall be able to demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a member and leader in a team, as well as to manage projects and multidisciplinary environments.

PO12. Life-long Learning: The students shall be able to recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Structure

Course: *M. Sc. (Electronics) SEMESTER - I*											
			Credits				Marks				
								End Term			
Course Code	**Course Title**	**Category**	**Lecture**	**Tutorial**	**Practical**	**Total**	**Internal**	**Theory**	**Lab**	**Total**
ELE19101C	Circuit Analysis and Synthesis	Core	2	0	1	3	15	40	20	75
ELE19102C	Antennas and Wave Propagation	Core	2	0	1	3	15	40	20	75
ELE19103C	Linear Integrated Circuits and Applications (LICA)	Core	2	0	1	3	15	40	20	75
ELE19104C	Digital Electronics and C-Programming Lab	Core	0	0	3	3	15	0	60	75
ELE19105DCE	Engineering Mathematics	DCE	4	0	0	4	20	80	NA	100
ELE19106DCE	CMOS VLSI and Nano-Electronics –I (MOSFET Theory)	DCE	3	0	1	4	20	60	20	100
ELE19107DCE	Signals and Systems	DCE	3	0	1	4	20	60	20	100
ELE19108DCE	Electronics Engineering Materials and Components	DCE	3	0	1	4	20	60	20	100
ELE19109DCE	Statistical Communication Theory	DCE	3	0	1	4	20	60	20	100
ELE19110DCE	Opto-Electronic Devices	DCE	3	0	1	4	20	60	20	100
ELE19111DCE	Data and Computer Communication	DCE	3	0	1	4	20	60	20	100
ELE19001GE	Foundations of Engineering Mathematics	GE	2	0	0	2	10	40	NA	50
ELE19002GE	Fundamentals of Signals and Systems	GE	1	0	1	2	10	20	20	50
ELE19003GE	Fundamentals of Data Communication	GE	1	0	1	2	10	20	20	50
ELE19004GE	Programming and Problem Solving Techniques	GE	1	0	1	2	10	20	20	50
ELE19001OE	Computing and Informatics -I	OE	1	0	1	2	10	20	20	50
ELE19002OE	Electronic Devices & Circuits-I	OE	1	0	1	2	10	20	20	50

Course: *M. Sc. (Electronics) SEMESTER - II*											
Course Code	**Course Title**	**Category**	**Credits**				**Marks**			
			Lecture	**Tutorial**	**Practical**	**Total**	**Internal**	**End Term**		**Total**
								Theory	**Lab**	
ELE19201C	Communication Engineering - I	Core	3	0	1	4	20	60	20	100
ELE19202C	Microprocessor Architecture and Programming	Core	3	0	1	4	20	60	20	100
ELE19203C	Power Electronic Circuits and Systems	Core	2	0	1	3	15	40	20	75
ELE19204C	Microwave Engineering	Core	2	0	1	3	15	40	20	75
ELE19205DCE	VLSI Technology	DCE	4	0	0	4	20	80	NA	100
ELE19206DCE	CMOS VLSI and Nano-Electronics – II (Digital IC Design)	DCE	3	0	1	4	20	60	20	100
ELE19207DCE	Optical Communication and Networks	DCE	3	0	1	4	20	60	20	100
ELE19208DCE	Design and Analysis of Active Filters	DCE	3	0	1	4	20	60	20	100
ELE19209DCE	Simulation and Modeling using MATLAB	DCE	3	0	1	4	20	60	20	100
ELE19210DCE	Wireless Adhoc and Sensor Networks	DCE	3	0	1	4	20	60	20	100
ELE19211DCE	Communication Hardware Design	DCE	3	0	1	4	20	60	20	100
ELE19005GE	Optical Fibre Communication	GE	1	0	1	2	10	20	20	50
ELE19006GE	System Simulation using MATLAB	GE	1	0	1	2	10	20	20	50
ELE19007GE	Data Structures	GE	1	0	1	2	10	20	20	50
ELE19008GE	Wireless Sensor Networks	GE	1	0	1	2	10	20	20	50
ELE19003OE	Computing and Informatics -II	OE	1	0	1	2	10	20	20	50
ELE19004OE	Electronic Devices & Circuits-II	OE	1	0	1	2	10	20	20	50

Course: *M. Sc. (Electronics) SEMESTER - III*										
Course Code	**Course Title**	**Category**	**Credits**				**Marks**			
			Lecture	**Tutorial**	**Practical**	**Total**	**Internal**	**End Term**		**Total**
								Theory	**Lab**	
ELE19301C	Physics of Semiconductor Devices	Core	4	0	0	4	20	80	NA	100
ELE19302C	Control System Engineering	Core	2	0	1	3	15	40	20	75
ELE19303C	Digital Signal Processing	Core	3	0	1	4	20	60	20	100
ELE19304C	Computer Networks	Core	3	0	1	4	20	60	20	100
ELE19305DCE	Microcontroller Architecture and Programming	DCE	3	0	1	4	20	60	20	100
ELE19306DCE	CMOS VLSI and Nano-Electronics – III (Analog and Mixed IC Design)	DCE	3	0	1	4	20	60	20	100
ELE19307DCE	Digital System Design using HDL	DCE	3	0	1	4	20	60	20	100
ELE19308DCE	Speech and Audio Processing	DCE	3	0	1	4	20	60	20	100
ELE19309DCE	Advanced Communication Systems	DCE	3	0	1	4	20	60	20	100
ELE19310DCE	RF Engineering	DCE	3	0	1	4	20	60	20	100
ELE19311DCE	Soft Computing and Neural Networks	DCE	3	0	1	4	20	60	20	100
ELE19312DCE	Cryptography and Information Security	DCE	3	0	1	4	20	60	20	100
ELE19313DCE	Advanced Microprocessors	DCE	3	0	1	4	20	60	20	100
ELE19009GE	Embedded Systems	GE	1	0	1	2	10	20	20	50
ELE19010GE	Modern Communication Systems	GE	1	0	1	2	10	20	20	50
ELE19011GE	Fundamentals of Fuzzy Logic	GE	2	0	0	2	10	40	0	50
ELE19012GE	Fundamentals of Information Security	GE	1	0	1	2	10	20	20	50
ELE19005OE	Computing and Informatics -III	OE	1	0	1	2	10	20	20	50
ELE19006OE	Electronic Devices & Circuits-III	OE	1	0	1	2	10	20	20	50

Course: *M. Sc. (Electronics) SEMESTER - IV*										
			Credits				Marks			
								End Term		
Course Code	**Course Title**	**Category**	**Lecture**	**Tutorial**	**Practical**	**Total**	**Internal**	**Theory**	**Lab**	**Total**
ELE19401C	Communication Engineering - II	Core	2	0	1	3	15	40	20	75
ELE19402C	Electronic Instrumentation	Core	2	0	1	3	15	40	20	75
ELE19403C	Industrial Training and Seminar Work	Core	0	0	4	4	50	NA	50	100
ELE19404C	Project Work	Core	0	0	5	5	25	NA	100	125
ELE19405DCE	Computer Organization and Architecture	DCE	3	0	1	4	20	60	20	100
ELE19406DCE	CMOS VLSI and Nano-Electronics – IV (Nanotechnology & Nanoelectronics)	DCE	3	0	1	4	20	60	20	100
ELE19407DCE	Wireless Cellular Communication	DCE	3	0	1	4	20	60	20	100
ELE19408DCE	Multimedia Technology and Security	DCE	3	0	1	4	20	60	20	100
ELE19409DCE	Fundamentals of RF Circuit Design	DCE	3	0	1	4	20	60	20	100
ELE19410DCE	Biomedical Instrumentation	DCE	3	0	1	4	20	60	20	100
ELE19411DCE	Digital Image Processing	DCE	3	0	1	4	20	60	20	100
ELE19412DCE	Cyber Security and Forensics	DCE	3	0	1	4	20	60	20	100
ELE19413DCE	Broadband Wireless Networks	DCE	3	0	1	4	20	60	20	100
ELE19013GE	Foundations of Computer Organization	GE	1	0	1	2	10	20	20	50
ELE19014GE	Mobile Communication	GE	1	0	1	2	10	20	20	50
ELE19015GE	Fundamentals of Biomedical Instrumentation	GE	1	0	1	2	10	20	20	50
ELE19016GE	Principles of Digital Image Processing	GE	1	0	1	2	10	20	20	50
ELE19017GE	Internet of Things (IoT)	GE	1	0	1	2	10	20	20	50
ELE19007OE	Computing and Informatics -IV	OE	1	0	1	2	10	20	20	50
ELE19008OE	Electronic Devices & Circuits-IV	OE	1	0	1	2	10	20	20	50

NOTES

1. Minimum credits to be earned for successfully completing M. Sc, Electronics Programme is 96 credits which have to be obtained as per the following distribution:

Category of Courses	Credits to be Earned
Core	56
Discipline Centric Elective	32
Generic/Open Elective	08

2. Pattern of Question Paper:
   a. Paper Type: Four Theory Credits
   b. Paper Type: Three Theory Credits
   c. Paper Type: Two Theory Credits
   d. Paper Type: One Theory Credit

a) Examination with Max. Marks=80 (Duration=150 minutes)

Section A: Questions carrying 02 mark each- 08 questions = 16 Marks.
Section B: Questions carrying Eight marks each-04 questions = 32 Marks.
Section C: Questions carrying Sixteen marks each-04 questions (Only 2 to be attempted) = 32 Marks.

b) Examination with Max. Marks=60 (Duration=105 minutes)

Section A: Questions carrying 02 mark each- 06 questions = 12 Marks.
Section B: Questions carrying Eight marks each-03 questions = 24 Marks.
Section C: Questions carrying Twelve marks each-03 questions (Only 2 to be attempted) = 24 Marks.

Examination with Max. Marks=40 (Duration=75 minutes)

Section A: Questions carrying 02 mark each- 04 questions = 8 Marks.
Section B: Questions carrying Eight marks each-02 questions = 16 Marks.
Section C: Questions carrying Sixteen marks each-02 questions (Only 1 to be attempted) = 16 Marks.

Examination with Max. Marks=20 (Duration=45 minutes)

Section A: Questions carrying 02 mark each- 02 questions = 04 Marks.
Section B: Questions carrying Six marks each-01 questions = 06 Marks.
Section C: Questions carrying Ten marks each-02 questions (Only 1 to be attempted) = 10 Marks.

Note: The examination of laboratory credits (if any) for courses shall be held on the same day.

Detailed Syllabus

Semester - I								
ELE19101C: Circuit Analysis and Synthesis							**Course Category: CORE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To prepare the students to have a basic knowledge regarding analysis of electric networks.
- To relate various two port parameters and transform them.
- To design various kind of filters.
- To enable students to synthesize passive networks.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire a comprehensive understanding of fundamental concepts in electrical circuits.
- Grasp circuit laws, mesh and nodal analysis, and various circuit theorems
- Apply basic circuit laws to simplify diverse networks through the application of network theorems.
- Gain proficiency in calculating different parameters for two-port networks and comprehending their interconnections.
- Develop the ability to determine the transfer function of various networks and analyse both the transient and steady-state behaviour of circuits.
- Navigate and manipulate electrical circuits effectively, laying a solid foundation for their understanding of advanced topics in the field.

Detailed Syllabus:

Unit I: Graph Theory, Network Equations and Two Port Parameters

Definition of Node, Branch, Graph, Sub-Graph, Path, Loop, Tree, Link and Twig, Network Matrices, Incidence Matrix, Loop Matrix, Loop, Cut -Set Matrix, Cut Set, Mesh Equations, Nodal equations, Source Transformations, Various Two Port parameters, O. C. Impedance and S. C. Admittance Parameters, parameters, chain Parameters, Image Impedance, Applications of various Two port Parameters to T and π - networks, Relationship between different two port parameters, Interconnection of Two port equivalent networks.

Unit II: Network Functions, Responses and Synthesis

Concept of Complex frequencies, system functions of Network, Driving Point and Transfer functions, Poles and Zeros of a network function, Impulse and step response of a first order system, Formulation of state equations for Electrical Networks and their solutions. Introduction to passive network synthesis, Hurwitz Positive Real Function (PRF), Basic Synthesis Procedure, Synthesis by inspection method, LC Immittance Functions *(realized by Foster-I and Foster II form, Cauer-I Form, Cauer-II Form),* RC Impedance Function, RL impedance , RC Admittance Functions.

Unit III: Laboratory Work

Verification of Source Transformation and Tellegens Theorms, Calculation of various two port parameters, To study impulse response of a first order system, To study oscillatory response and its relation with pole location. Synthesis of some passive networks

Books Recommended:

1. Networks and Systems by D.R. Choudury, Wiley Eastern Ltd: New Delhi.
2. Network Analysis by M. E. Valkenburg, Prentice Hall India.
3. Basic Circuit Theory by Charles A. Desoer and Ernest S. Kun, McGraw H
4. Circuit Analysis with Computer Application to Problem Solving by Gupta, Baylessand Piekari, Willey Eastern Ltd, New Delhi
5. Network Analysis theory and compute methods by donson and Watkins, Prentice Hall, New Delhi.

Semester - I								
ELE19102C: Antennas and Wave Propagation						**Course Category: CORE**		
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- Use Maxwell's equations to calculate fields from dynamic charge/current distributions.
- Analyze plane waves in lossless and lossy media.
- Calculate fields from antennas and antenna systems.
- To study various polarization techniques.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Apply Maxwell's equations to calculate electromagnetic fields from dynamic charge and current distributions.
- ➢ Analyse plane waves in both lossless and lossy media, understanding wave polarization and power flow.
- ➢ Understand antenna radiation mechanisms, including potential functions, radiation patterns, and power radiated.
- ➢ Conduct experiments using microwave antenna training systems, design dipole antenna systems, and utilize simulation tools like CST or HFSS.
- ➢ Investigate various polarization techniques, distinguish between horizontal and vertical polarizations, and communicate findings effectively.

Detailed Syllabus:

Unit I: Maxwell's Equations and Electromagnetic Waves

Maxwell's Equations in differential and integral form. Equations of continuity for time varying fields, inconsistency of Amperes law, Boundary condition, Boundary Conditions at media interface (Dielectric and Conducting interface). Homogenous unbounded medium, Wave equation for time harmonic fields, solution of the wave equation, uniform plane wave, wave polarization, power flow and pointing vector (Physical interpretation), plane wave at dielectric interface, reflection and refraction of waves in dielectric interface, Normal Incidence on a layered medium, Total Internal Reflection, Wave Polarization at Media interface.

Unit II: Antenna Radiation Mechanism and Structures

Basics of antenna radiation, Potential functions, solution of potential functions, radiation from the hertz dipole, total power radiated by the hertz dipole, radiation resistance of the hertz dipole, radiation pattern of the hertz dipole, directivity, antenna gain, effective area of antenna. Folded dipole antennas, modification of folded dipoles, loop antennas, far-field patterns of circular loop antennas, introduction to microstrip antennas.

Unit III: Laboratory Work

Measurement of Antenna Parameters using Microwave Antenna Training System, Plot of Polarization (Horizontal and Vertical). Design of dipole antenna system using waveguide. some experiments using Microwave Antenna Trainer and CST Tool or HFSS.

Books Recommended:

1. Antennas and Wave propagation: John D Kraus, Ronald J Marhefka, Ahmad S Khan McGraw Hill, 4th edition.
2. Electromagnetic Waves: R. K. Shevgaonkar Tata McGraw Hill.

Semester - I								
ELE19103C: Linear Integrated Circuits and Applications (LICA)						**Course Category: CORE**		
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To Study the basic principles, configurations and practical limitation of op-amp.
- To understand the various linear and nonlinear applications of op-amp.
- To analyze and design OP-AMP based oscillators and frequency generators.
- To understand the operations of the most commonly used D/A and A/D converter types and its applications.
- To analyze and design PLL and 555 timer based circuits.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the various applications of linear IC's like 741 and 555 timer.
- Use OP Amp to design different arithmetic circuits.
- Use OP Amp to generate sine, square and triangular wave forms.
- Use OP Amp as analog to digital and digital to analog converter.
- Design simple circuits using voltage regulators and IC 555

Detailed Syllabus:

Unit I: Operational Amplifier Characteristics Applications

Differential Amplifier, Current Mirrors, Active Loads, Non- ideal parameters of OP- AMPs, Frequency response of OP- Amps, Compensation, Pole – Zero compensation, Dominant pole compensation, Linear Applications of Op-amps: Amplification (Inverting Amplifier, Non-inverting Amplifier, Instrumentation Amplifier),Integration and Differentiation; Electronic analog computation, Active filters, Sample and hold systems, Analog multiplexer, Logarithmic and Exponential amplifiers, Digital-to-Analog (Weighted Resistor, R-2R Ladder Network) and Analog-to-Digital Converters (Flash, Successive Approximation).

Unit II: Wave shaping and Wave generators

Rectifiers, Clippers and Clampers, Peak Detector, Comparators, Applications of comparators, Schmitt-trigger, Square wave and triangular wave generators, pulse generators, voltage time-base generators, Step (Stair-case) generators, sinusoidal Oscillators: Phase shift oscillator, Wien-bridge oscillator, 555 timer: Applications as Astable and Monostable Multivibrator, Phase locked loop (PLL): Applications as Frequency Synthesizer, FM demodulator, Voltage regulators: Fixed voltage regulators, Adjustable voltage regulators, switching regulators.

Unit III: Laboratory Work

The laboratory work shall include minimum 10 practicals on Op-Amp Characteristics, Linear applications; Wave shaping, signal generation, PLL and 555 timer.

Books Recommended:

1. Milliman, Integrated Electronics, McGraw hill Book company
2. Milliman and Grabel, Microelectronics, McGraw Hill Company
3. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Mc-Graw Hill, 2002.
4. R. A. Gayakward , OP- Amp and Linear Integrated Circuits, Prentice Hall of India Ltd.

Semester - I

ELE19104C: Digital Electronics and C-Programming Lab — **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
0	0	3	3	15	0	60	75	1 ¾ Hours

Learning Objectives:

- To acquire the basic knowledge of digital logic levels and application to understand digital electronic circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.
- To develop programming skills using C-programming.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the basic knowledge of digital electronics, covering logic gates (AND, OR, NOT, etc.), combinational and sequential logic circuits.
- Design and implement Combinational and Sequential logic circuits. Perform the analysis and design of various digital electronic circuits.
- Emerge with a comprehensive understanding of C programming language, emphasizing the process of writing, compiling, and executing programs using appropriate predefined functions.

Detailed Syllabus:

Unit I: Experiments on Digital Electronics-I

1 To design basic logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using discrete components.
2 To design basic logic gates (AND, OR, NOT) using universal gates.
3 To verify Boolean expressions using basic and universal gates.
4 To design and realize Half and Full Adder Circuits using basic logic gates/universal gates. To design a 4-bit magnitude comparator using basic/universal logic gates.
5 To design a digital clock using ICs.
6, a) To design a 4:1 multiplexer and 1:4 de-multiplexer circuits using basic/universal logic gates.
b) To implement a 4/5 variable Boolean function using a suitable MUX.
7. a) To design a 2^n to n line encoder using basic universal logic gates.
b) To design a control signal generator for 2^n :1 MUX and 1: 2^n DEMUX using decoder.
8. a) Design a BCD to 7 segment decoder using IC"s (7447).
b) To design a circuit that can encode a particular sequence and decode the same sequence.
c) To design a ROM that can store a particular sequence.

Unit II: Experiments on Digital Electronics-II

1. To implement a 4/5 variable Boolean function using ROM and decoders.
2. (a) To design the following flip-flops using universal gates.
I) S-R flip-flop II) D flip-flop III) J-K flip-flop and IV) T flip-flop
(b) Study race around condition of J-K flip-flop and design edge-triggered J-K-flip flop and M/S flip-flop to eliminate race around condition.
3. (a) To design an n-bit serial adder using full adder and D type flip flop IC"s.
(b) To design a universal shift register and demonstrate SISO, SIPO, PISO and PIPO functions.
4. (a) To design a modulo-n Asynchronous and synchronous counter using JK/T-Flip Flop IC"s.
(b) To design up-down synchronous counter with direction control that can count a particular sequence.
(c) To design Johnson & Ring counter.

Unit III: Programming with C Language-I

1. (a) Write a program to evaluate the sine using recursive and non-recursive functions.
2. Write down and execute a C-Programme for the following:
(a) To determine the value of a given Resistor from its color Code.
(b) To match a frequency with the various divisions of the frequency spectrum and display its location.
(c) To check whether a transistor is NPN or PNP
(d) To accept the name of a transistor and output the package type, manufacturer, operating frequency range, and material used.
(e) To accept parameters of a transformer and calculate its output voltage
(f) To accept one of the three parameters (peak voltage, average and rms) of a signal and calculate the other two parameters in half-wave and full-wave rectifier along with ripple factor.
(g) To accept the changes in the current IB, IC, and IE of a transistor and calculate the current amplification factors in cases of common-base, common-emitter, and common-collector amplifiers.
(h) To calculate the extreme points of a load line and operating point using the given parameters.
(i) Current flowing through a Semiconductor diode is given by

$$I_D = I_s[\exp(v_D/nv_{th}) - 1]$$

Where VD is Voltage across diode, Is is saturation current, n is Emission coefficient and Vth is Thermal voltage. Write a program to calculate and plot the current flowing through the diode for voltages from –4.0 Volts to 1.0 Volts in steps of 0.1.

3. a) Write down a program which will convert a decimal number to its equivalent representations in hexadecimal, octal and binary number systems. The program should display the number in all of above number systems.

b) Write a C program that converts a decimal number to its equivalent number in new base. The decimal number and the new base are to be read as command line arguments.

4. Write down a program to compute

a) Equivalent resistance of the resistors connected in: I) Series II) Parallel.

b) Equivalent resistance of the capacitors connected in: I) Series II) Parallel.

c) Equivalent resistance of the inductors connected in: I) Series II) Parallel.

5. a) Write down a program to calculate the output voltage for Damped Sinusoidal Oscillator.

b) Write down a program to calculate the oscillating frequency of a damped RLC circuit.

c) Calculate the energy stored in an inductor which is given by:

E = ½ × inductance × current 2

6. Write down a program to calculate the total percentage Harmonic Distortion of a device for the given strengths of fundamental and harmonic components.

7. Write a program to accept the color code of resistors and sort them in ascending or descending order of their values using arrays.

8. Write a to read a string and a key. Encrypt the string using this key. Display the encrypted string. In the same program read the key again decrypt the string and display the original string using functions.

9. Write a computational program for solving simultaneous algebraic equations by Guassian Elimination method and use it for solving a given linear network.

Books Recommended:

1. Malvino and Leach "Digital principles and Applications" Tata McGraw Hill.
2. Jain R P "Modern Digital Electronics", Tata McGraw-Hill, Third Edition, (2003)
3. Mano M Morris, "Digital Design" Pearson Education, Third Edition, (2006)
4. Deitel, "C How To Program"
5. Byron Gottfried "Programming with C"
6. E. Balaguruswamy, "Programming with ANSI-C"

Semester - I

ELE19105DCE: Engineering Mathematics — **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
4	0	0	4	20	80	0	100	2 ½ Hours

Learning Objectives:

- To understand Fourier series and its applicability in different fields.
- To understand the Fourier transform and its application in electronics.
- To use Laplace transform methods to solve differential equations.
- To have the idea of complex variables and application of its functions in system stability.

Learning Outcomes

After studying the course, the students shall be able to:

- Conceptualize and model the engineering problems in frequency domain.
- Apply the frequency transformation method for analysis of circuits.
- Understand and apply the methods in s-domain.
- Evaluate complex contour integrals directly and by the fundamental theorem.
- Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

Detailed Syllabus:

Unit I: Fourier Series

Periodic Functions, Fourier Series: Determination of Fourier Coefficients, Fourier Series of periodic functions, even and odd functions, Fourier Series for arbitrary period, Half Range Series, Half-wave expansion, Fourier Integral Theorem, Fourier Sine and Cosine integrals.

Unit II: Fourier Transform

Dirichlet's Condition, Properties of Fourier Transforms, Fourier Transform and Dirac delta function, Application of Fourier Transformation in Electronics.

Unit III: Laplace Transformation

Laplace transforms & its properties, Inverse of Laplace transform by partial fractions, solution of second order differential equation using Laplace transform, Application of Laplace transform in Electrical Networks.

Unit IV: Function of Complex Variable

Analyticity of Complex variables, Cauchy Riemann Conditions, Cauchy integral Theorem, Laurent's Series, Singularities, Poles, Residues, Residue Theorem, Contour integration for Trigonometric functions (0 to 2π) , Contour Integration for functions (-∞ to +∞), Application of Functions of Complex variables in System Stability.

Books Recommended:

1. Applied Mathematics for Engineers and Physicist by Pipes and Harvill, McGraw Hill Book Company.
2. Advanced Engineering Mathematics by Edwin Kreyzing, Wiley Eastern Ltd.
3. Advanced Engineering Mathematics by H. K. Das, S. Chand Publishing Company.
4. Numerical Methods for Engineers and Scientists by A.C. Bajpai, I. M. Calus and J. A.Fairley, John Wiley & Sons
5. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain. New Age International Publisher.
6. Statistical Methods by S. P. Gupta, S Chand and Company.
7. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale, TMH
8. Fourier Transformation and Laplace Transformations, Schaum Series Book ,TMHCourse

Semester - I

ELE19106DCE: CMOS VLSI and Nano-Electronics –I (MOSFET Theory) **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To acquaint the students with the trends in modern VLSI.
- To understand the operation of MOSFET.
- To study MOSFET characteristics and small channel effects.
- To introduce students to the alternative devices proposed to replace MOSFET in the future.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the basic Physics and Modelling of MOSFETs.
- Develop mathematical models for modern MOS devices.
- Understand the CMOS circuit characteristics, performance parameters, various parasitic elements and scaling process.
- Develop solution to overcome short channel issues.
- Develop various compact models appropriate for industry.
- Analyse current distribution in the devices like transistors, MOS devices.
- Comprehend the layout design rules, stick diagrams and fabrication process of CMOS technology.

Detailed Syllabus:

Unit I: MOSFET Operation

Long Channel MOSFET devices: Drain current model, MOSFET I-V characteristics, Regions of operation, sub-threshold characteristics, MOSFET channel mobility, MOSFET capacitance and inversion layer capacitance effect, MOSFET parasitic elements. MOS transistor with Ion-Implanted channels: Enhancement n-MOS transistors, Depletion n-MOS transistors, Enhancement p-MOS transistors.

Unit II: Threshold Voltage and Small Channel Effects

Threshold Voltage: Threshold variation with device length and width and temperature dependence of threshold voltage. Small channel effects: Channel length modulation, barrier lowering, two dimensional charge sharing and threshold voltage, Punch Through, Carrier velocity saturation, Hot carrier effect-substrate current, gate current and breakdown, effect of surface and drain series resistance, effects due to thin oxides and high doping.

Unit III: MOSFET Scaling and Parasitics

Scaling theory in MOSFETs: Effect of scaling theory on drain current, device capacitances, delay, power dissipation, Transconductance and output impedance. VLSI device structure: Gate material, non-uniform channel doping, source drain structures, device isolation, MOSFET parasitic elements, MOS capacitor with no applied voltage and at non-zero bias.

Unit IV: Laboratory Work

The laboratory work shall include minimum of 10 practicals on MOSFET characteristics, Modeling and PSPICE

Books Recommended:

1. N. Arora, MOSFET Models for VLSI Circuit Simulation, Springer-Verlag Wien New York.
2. Yuan Taur and Tak H. Ning, Fundamentals of modern VLSI Devices, Cambridge University Press.
3. YannisTsividis, Operation and Modeling of MOS transistor, WCB/McGraw-Hill, New York.

Semester - I

ELE19107DCE: Signals and Systems **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand of various type of signals.
- To understand the fundamental properties of linear systems.
- To analyze various circuits using transforms.
- To understand signal transformation and its applications.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand mathematical description and representation of continuous and discrete time signals and systems.
- Develop a thorough understanding of input output relationship for linear shift invariant system and understand the role of convolution operator for continuous and discrete time system.
- Resolve the signals in frequency domain using Fourier series and Fourier transforms. Besides developing ability to analyze the system in s-domain.
- Understand the basic concept of probability, random variables & random signals and develop ability to find correlation, CDF, PDF and probability of a given event.
- Gain hands-on practical experience through the implementation of some fundamental signal processing algorithms using MATLAB.

Detailed Syllabus:

Unit I: Introduction to Signals, Systems and Transform Techniques

Representation and Classifications of Continuous and Discrete Time Signals and Systems; Fourier Series Representation; Singularity Functions; Convolution Integral; Impulse Response and Its Properties, Fourier Transform and Its Properties; Sampling; Discrete Time Fourier Transform; Discrete Fourier Transforms.

Unit II: Analysis Using Transforms

Review of Laplace Transform; Hilbert Transform System Analysis Using Fourier and Laplace Transforms of I & II Order Systems; Transfer Function; Z-Transform and Its Properties Discrete Time System Analysis Using Z-Transform.

Unit III: Random Signals

Review of Random Variables; Probability Distribution and Probability Density Functions; Uniform, Gaussian, Exponential and Poisson Random Variables; Statistical Averages; Random Processes; Correlation; Power Spectral Density; Analysis of Linear Time Invariant Systems With Random Input; Noise and Its Representations

Unit IV: Laboratory Work

Generation of various signals and sequences using MATLAB. Computation of Correlation and convolution of various signals using MATLAB. Fourier Transform and DFT computation, Study of sampling and quantization. Study of PSD of various signals. System solutions.

Books Recommended:

1. Alan V, Oppenheim and A.S Wilsky, Signals and Systems, prentice Hall India
2. Simon Hykin, Signals and systems, John Wiley.
3. B. P Lathi, Signals and systems
4. Simon hykin, Communication systems, John wiley

Semester - I

ELE19108DCE: Electronics Engineering Materials and Components **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To know about various electronic components.
- To understand electrical and magnetic properties of materials.
- To understand the phenomena of semi-conductors, operation of diodes, BJT and FET.

Learning Outcomes

After studying the course, the students shall be able to:

- Identify and explain properties of electronic materials.
- Analyze semiconductor device behavior and characteristics.
- Understand and analyze passive and active electronic components.
- Apply circuit analysis techniques and design electronic circuits.
- Design and analyze digital circuits using logic gates.
- Study materials and components for RF applications.
- Apply knowledge to practical projects, including soldering and troubleshooting.
- Follow safety protocols in handling electronic materials.

Detailed Syllabus:

Unit I: Electrical and Magnetic Properties of Materials

Classification of electrical materials; Fundamentals of Atomic Structure and Chemical Bonding; Structure and properties of conductors, semi-conductors and insulators, Structure and properties of magnetic materials, ferroelectric, piezo-electric, ceramic optical and superconducting materials. Structure of solids : Crystalline and Non-crystalline states; Crystallographic directions and phases; Determination of crystal structures.

Unit II: Electronic Components

Passive components; Resistors, capacitors, inductors and their types; color coding; ferrites, Quartz crystal and ceramic resonators, electromagnetic and electromechanical components.

Unit III: Physical Electronics

Electrons and holes in semiconductors; Hall effect; mechanism of current flow in a semi-conductor, junction theory, different types of diodes and their characteristics (rectifying, Zener, LED, Photo). Introduction to three terminal devices (BJT and FET).

Unit IV: Laboratory Work

The students are required to conduct at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. Electronic Devices and Circuit Theory. By: Robert Boylston& Louis Nashelsky. Prentice Hall.
2. Elements of Materials Science & Engineering. By: L.H. Van Vlack. Addison-Wesley Publishing Company, New York.

Semester - I								
ELE19109DCE: Statistical Communication Theory							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To have the knowledge of random variables and random processes.
- To know about the process and types of filtering.
- To understand applicability of random process theory in communication.

Learning Outcomes

After studying the course, the students shall be able to:

- Show how the information is measured and able to use it for effective coding.
- get acquaintance with how the channel capacity is computed for various channels.
- Use various techniques involved in basic detection and estimation theory to solve the problem.
- Summarize the applications of detection theory in telecommunication.
- Summarize the application of estimation theory in telecommunication

Detailed Syllabus:

Unit I: Random Variables and Random Process

Discrete Time Random Processes: Random Variables, Uncorrelated and Orthogonal Random Variables, Linear Mean Square Estimation. Gaussian Random Variables, Parameter Estimation: Bias and Consistency, Random Processes, Stationary Processes.

Unit II: Filtering Process

Filtering Random Processes: Wiener Filtering, the FIR Wiener filter, Linear Prediction, Noise Cancellation, IIR Wiener filter, Noncausal IIR Wiener filter, Causal IIR Wiener filter Discrete Kalman filter.

Unit III: Multirate Filtering

Adaptive filtering-LMS algorithm. Spectrum Estimation: Bay's estimation, Nonparametric methods, Minimum variance spectrum estimation, Frequency estimation.

Unit IV: Laboratory Work

Matlab Implementation and study of Filtering Random Processes: Spectral factorization, Wiener Filtering, the FIR Wiener filter, Linear Prediction, Noise Cancellation, IIR Wiener filter, Noncausal IIR Wiener filter, Causal IIR Wiener filter Discrete Kalman filter. Adaptive filtering-LMS algorithm. Spectrum Estimation: Bay's estimation, Nonparametric methods, Minimum variance spectrum estimation, Frequency estimation.

Books Recommended:

1. An introduction to statistical communication theory, David Middleton, McGraw-Hill, 1960
2. An Introduction to Statistical Communication Theory: An IEEE Press Classic Reissue. David Middleton Wiley, 08-May-1996 - Technology & Engineering - 1152 pages

Semester - I								
ELE19110DCE: Opto-Electronic Devices							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand basic laws and phenomena in the area of Opto-electronics and LASER.
- To have the knowledge of materials for dielectric wave guides.

Learning Outcomes

After studying the course, the students shall be able to:

- Explain the basic physical processes involved in optoelectronic transitions and demonstrate the application of these principles to various optoelectronic devices.
- Provide a comprehensive definition of the principles and functionality of key optoelectronic devices, and conduct a comparative evaluation of various device designs.
- Conduct modeling to scrutinize the physics underlying semiconductor optoelectronic devices.
- Construct a basic integrated optoelectronic device or setup using diverse components, conduct measurements, interpret acquired data, and engage in problem analysis and resolution.

Detailed Syllabus:

Unit I: Light Sources and Detectors

Black body radiation sources of light and their spectral characteristics. Interaction of radiation with matter, photo conductivity, photo detectors and their figures of merits, PIN and APD diodes and their temperature dependence, Introduction to Solar Cells, Solar Cells, Luminescence and their uses, Optical Sources.

Unit II: Lasers

Theory of stimulated emission and optical oscillator in solid state Semiconductor, dye lasers. Laser Diode, Nonlinear optical effect. Propagation characteristics of optical fiber.

Unit III: Materials for Dielectric Waveguides

Material and wave guide dispersions. Modulation and detection of optical signals, nonlinear propagation and interaction, organic and inorganic optical wave guides, fibre amplifiers, integrated optical devices.

Unit IV: Laboratory Work

Characteristics of LED, Characteristics of LD Characteristics of PD & APD Optical Time Domain Reflectometer (OTDR) Kerr effect Pockel's effect Spectral characteristics of LED and LD Wavelength division multiplexing of signals, Fiber-Optic System Bandwidth estimation, Single Mode Fiber Characteristics.

Books Recommended:

1. J. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
2. P. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn Pearson Education, Singapore, 2002.

Semester - I								
ELE19111DCE: Data and Computer Communication							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand the fundamental concepts of data communications and networking.
- To have the knowledge of protocols and its architecture.

Learning Outcomes

After studying the course, the students shall be able to:

- Demonstrate a solid grasp of data and computer communication principles, including OSI and TCP/IP

models.
- ➢ Analyze and implement various networking protocols like TCP, UDP, IP, and HTTP.
- ➢ Understand data link layer functionalities, error detection, and correction, along with principles of the physical layer.
- ➢ Evaluate and configure networking devices such as routers, switches, and hubs.
- ➢ Comprehend wireless communication principles and design basic wireless networks.
- ➢ Explore the impact and implementation of emerging technologies like IoT and 5G.

Detailed Syllabus:

Unit I: Introduction

Introduction, Network Models, Data and Signals, Shannon's Theorem and its Applications, Composite Signals, Encoding and Modulation, Multiplexing, and Introduction to Spread Spectrum Modulation, Guided Media and Unguided Media, Switching Techniques, Circuit Switching and Packet Switching and Message Passing.

Unit II: Error Detection and Correction

Types of errors, Redundancy, Detection versus Correction, Coding, error detection, Cyclic Redundancy Check, Cyclic Code Encoder Using Polynomials, Checksum Method, Hamming Code and Linear Block Code Technique.

Unit III: Introduction to Protocol Architecture

The Need for a Protocol Architecture, A Simple Protocol Architecture, OSI, The TCP/IP Protocol Architecture, Data Link Control: Framing, Flow and Error Control, Introduction to DLC protocols, High-Level Data Link Control (HDLC), Point-to-Point Protocol (PPP), and Media Access Control.

Unit IV: Laboratory Work

The laboratory work shall be based on unit I through unit IV and shall use hardware study as well as experiments using simulations.

Books Recommended:

1. B. A. Forouzan, Data Communications and Networking, TMH.
2. William Stallings, Data and Computer Communications, 10/E, Pearson.
3. P.C. Gupta – Data Communications and Computer Networks, PHI.

Semester - I

ELE19001GE: Foundations of Engineering Mathematics — **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	0	2	10	40	0	50	1 ¼ Hours

Learning Objectives:
- To understand Fourier series and its applicability in different fields.
- To understand the Fourier transform and its application in electronics.
- To use Laplace transform methods to solve differential equations.

Learning Outcomes

After studying the course, the students shall be able to:
- ➢ To understand Fourier series, Fourier and Laplace transformation and their applicability in the different fields of science and technology.
- ➢ Conceptualize and model the engineering problems in frequency domain.
- ➢ Apply the frequency transformation method for analysis of circuits.
- ➢ Understand and apply the methods in s-domain.

Detailed Syllabus:

Unit I: Laplace Transformation

Laplace transforms & its properties, Inverse of Laplace transform by partial fractions, solution of second order differential equation using Laplace transform, Application of Laplace transform.

Unit II: Fourier Series and Transformation

Fourier Series: Determination of Fourier Coefficients, Fourier Series for arbitrary period, Fourier Transforms: Properties of Fourier Transforms, , Application of Fourier Transformation.

Books Recommended:

1. Applied Mathematics for Engineers and Physicist by Pipes and Harvill, McGraw Hill Book Company.
2. Advanced Engineering Mathematics by Edwin Kreyzing, Wiley Eastern Ltd.
3. Advanced Engineering Mathematics by H. K. Das, S. Chand Publishing Company.
4. Numerical Methods for Engineers and Scientists by A.C. Bajpai, I. M. Calus and J. A.Fairley, John Wiley & Sons
5. Fourier Transformation and Laplace Transformations, Schaum Series Book ,TMHCourse

Semester - I

ELE19002GE: Fundamentals of Signals and Systems **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To have the knowledge of various types of signals.
- To understand the fundamental properties of linear systems.
- To analyze various circuits using transforms.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand mathematical description and representation of continuous and discrete time signals and systems.
- Develop a thorough understanding of input-output relationship for linear shift invariant system and understand the role of convolution operator for continuous and discrete time system.
- Resolve the signals in frequency domain using Fourier series and Fourier transforms. Besides developing ability to analyse the system in s-domain.

Detailed Syllabus:

Unit I: Introduction

Introduction to Signals and Systems Representation and Classifications of Continuous and Discrete Time Signals and Systems; Fourier Series Representation; Singularity Functions; Convolution Integral; Impulse Response and Its Properties.

Unit II: Transform Techniques

Fourier Transform and Its Properties; Laplace Transforms and its Properties, Hilbert Transform; Review of Laplace Transform; Z-Transform and Its Properties; Discrete Time Fourier Transform; Discrete Fourier Transforms.

The laboratory work shall include minimum 10 practicals

Books Recommended:

1. Alan V, Oppenheim and A.S Wilsky, Signals and Systems, prentice Hall India
2. Simon Hykin, Signals and systems, John Wiley.
3. B. P Lathi, Signals and systems,
4. Simon hykin, Communication systems, John wiley

Semester - I

ELE19003GE: Fundamentals of Data Communication **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To understand the fundamental concepts of data communications and networking.
- To get acquainted with A/D and D/A conversion.

Learning Outcomes

After studying the course, the students shall be able to:

- Recognize the concept of analog and digital signals and their use in day-to-day communication.
- Identify which transmission impairments cause problems in communication and their remedies.
- Appreciate the importance of date rate limits in communication and performance measurement.

Detailed Syllabus:

Unit I: Introduction:

Data representation and flow, Analog and Digital Data, Analog and Digital Signals, Periodic Analog Signals (Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth), Digital Signals (Bit Rate, Bit Length), Digital Signal as a Composite Analog Signal, Transmission of Digital Signals, Transmission Impairment (Attenuation, Distortion, Noise), Data rate limits (Noiseless Channel: Nyquist Bit Rate, Noisy Channel: Shannon Capacity), Performance Parameters, Digital Transmission: Digital to Digital Conversion, analog to digital conversion, transmission modes), Analog Communication: Digital to Analog Conversion, Analog to Analog Conversion). Introduction to multiplexing and spectrum spreading.

Unit II: Error Detection and Correction:

Types of errors, Redundancy, Detection versus Correction, Coding, error detection, Cyclic Redundancy Check, Cyclic Code Encoder Using Polynomials, Cyclic Code Analysis, Advantages of Cyclic Codes, Other Cyclic Codes, Hardware Implementation, checksum, Forward error correction using Hamming distance, XOR, Chunk Interleaving, etc.

The laboratory work shall include minimum 10 practicals

Books Recommended:

1. B. A. Forouzan, Data Communications and Networking, TMH.
2. William Stallings, Data and Computer Communications, 10/E, Pearson.
3. P.C.Gupta – Data Communications and Computer Networks, PHI.

Credits	Total	Maximum Marks	Time Allowed for

Semester - I

ELE19004GE: Programming and Problem Solving Techniques **Course Category: GE**

Lecture	Tutorial	Practical	Total	Internal	End Term Theory	End Term Lab	Total	Time Allowed for
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To develop programming skills using the fundamentals and basics of C language.

Learning Outcomes

After studying the course, the students shall be able to:

- Develop algorithmic Thinking.
- Understand software Development Process.
- Perform problem Analysis and Decomposition.
- Understand programming language Constructs.
- Understand syntax and Semantics.
- Understand modular Programming.
- Understand data Structures.
- Perform file Management.

Detailed Syllabus:

Unit I: Introduction to Problem Solving Concepts

The Basic Model of Computation, Algorithms, Flow-charts, Programming Languages, Compilation, Linking and

Loading, Testing and Debugging, Documentation, Algorithms for Problem Solving - Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Evaluate a Polynomial.

Unit II: Introduction to C Programming

Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, assignment and Basic input/output statement, Conditional Statements and Loops- Relational Operators, Logical Connectives, Switch Statement, Structured Programming, Arrays, Operation on Arrays; Functions and their Applications, Standard Library of C functions and Pointer Arithmetic.

Books Recommended:

1. Deitel, "C How To Program",
2. Byron Gottfried "Programming with C",
3. E. Balaguruswamy, "Programming with ANSI-C",
4. Kamthane, "Programming with ANSI & Turbo C", 5. Herbert Schildt C++-The Complete Reference.

Semester - I

ELE-19001OE: Computing and Informatics - I **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To get the basic knowledge of computers.
- To learn about the operating systems and application software.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand fundamental Knowledge of Computer Hardware.
- Gain knowledge of types of Softwares.
- Gain insights of Windows and Unix Operating System.
- Perform practical Implementation of Office Tools.

Detailed Syllabus:

Unit I: Introduction to Problem Solving Concepts

Computer basics. History, generations and classification of computers; Number systems; Hardware. Components of a computer input/output devices, CPU unit and memory unit, secondary storage. Software, System software, application software, compilers and translators. Operating systems. Introduction to operating systems;' types of operating systems and their functions, popular operating systems- Linux, UNIX and Windows.

Unit II: Laboratory Work:

Identification of various internal and external parts of computer system, connecting various parts of computer system, learning basic commands for file management on windows operating system, learning to create, format and print documents, spreadsheets and presentations, Internet and applications.

Books Recommended:

1. V. Srivastava "Computing and Informatics" IstEdition S. K. Kataria& Sons.
2. Chandwani "Computing and Informatics" Jain Brothers.
3. AnitalGoel "Computer Fundamentals" Pearson
4. P.K.Sinha "Computer Fundamentals" BPB Publications.

Semester - I

ELE-19002OE: Electronic Devices & Circuits - I **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To understand the fundamentals of passive components.
- To acquire the knowledge of active components, networks and circuit laws.

Learning Outcomes

After studying the course, the students shall be able to:

- Identify the different types of passive components.
- Know the characteristics of various components.
- Understand the utilization of components.
- Identify the different types of signals.
- Understand the laws relationships among different electronic signals.

Detailed Syllabus:

Unit I: Fundamental of Passive Components

Voltage, current, resistance, Ohm's Law, Resistor: Classification of resistors, Series and parallel connection. Colour code and application. Specifications & use. Capacitor: Capacitance & capacitive reactance. Classification of capacitors, dielectric constants, materials used, Series and parallel connection. Inductor: Inductance, self and mutual inductance, Resonance, Series and parallel connection.

Unit II: Signal Laws, Representations and Transformations

Voltage and Current sources, concept of AC/DC. Signal Waveforms, Amplitude, frequency, wavelength. Spectrum and bandwidth. Networks and circuits, Kirchhoff's current law (KCL) and Kirchhoff s voltage law (KVL), Instantaneous values, R.M.S. values, phase-cycle. Transformers, step-up and step down, turns ratio and wire guages, efficiency. Concept of generators & motors.

Lab Work:

- Resistance calculation using color code.
- Ohms Law, KCL and KVL.
- Series and Parallel combination of Resistors and capacitors.
- Measurement Time period, Frequency and RMS value and Average value of a sinusoid.
- Current, voltage and resistance measurement using multimeter.
- Analytical study of step-up and step-down transformers

Books Recommended:

1. Del Torro, "Electrical Engineering Fundamentals", 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
2. W.H. Hayt and J.E. Kemmerly, "Engineering Circuit Analysis," Mc-Graw Hill Delhi (1996).

Semester - II

ELE19201C: Communication Engineering - I — **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand the probabilistic phenomenon in communication systems.
- To understand the transmission of signals through communication channels.
- To understand analog communication systems using amplitude modulation and demodulation.
- To learn about analog communication systems using angle modulation and demodulation.
- To know about various types of noise in communication systems.

Learning Outcomes

After studying the course, the students shall be able to:

- Gain a grasp of probabilistic phenomena in communication systems, enabling the analysis of random processes and uncertainties in signal transmission.
- Acquire knowledge of AM and demodulation techniques, including the generation of DSB-SC, SSB, and VSB signals.
- Develop proficiency in angle modulation, covering the mathematical theory, bandwidth calculation, and generation of FM signals. Understand noise analysis in AM and FM systems.
- Explore PCM concepts, including sampling theorem, quantization (uniform and non-uniform), companding, and the encoding of signals. Understand the impact of noise on PCM systems.
- Apply theoretical knowledge in a practical setting by designing and realizing AM and DSB-SC modulators and demodulators using ICs. Simulate SSB-SC modulators and demodulators using MATLAB/Simulink.
- Gain practical experience with FM generation and detection, and study operational amplifier-based pre-emphasis and de-emphasis circuits.

Detailed Syllabus:

Unit I: Amplitude Modulation and Demodulation

Introduction to Signals and its classification, Basic Mathematical theory of A. M modulation, Time domain and Frequency domain representation, Generation and demodulation of Amplitude Modulation, Double Side band Suppressed Carrier, (DSB- SC) System, Generation and Demodulation of DSB- SC signals, Advantages of SSB transmission, Generation of SSB; Vestigial Side-Band Modulation (VSB). SSB and VSB demodulation, independent sideband transmission and reception.

Unit II: FM Modulation, Reception and Noise

Concept of Angle Modulation: Mathematical theory, Bandwidth calculation, Generation of FM by Direct Methods. Indirect Generation of FM; The Armstrong Method, FM Receiver Direct Methods of Frequency Demodulation; Slope Detector, FM Detector using PLL, Noise in Communication System, Time-domain representation of Narrow band Noise, Filtered White Noise, Noise figure. AM Receiver model, Noise analysis of DSBSC and SSBSC using coherent detection, Noise in AM using Envelope detection, Noise in FM using Limiter-discriminator detection, FM threshold effect, Pre- emphasis and De-emphasis in FM.

Unit-III: Pulse Code Modulation

Sampling Theorem, Signal Reconstruction: The Interpolation Formula, Elements of Pulse Code Modulation (PCM), Quantization: Uniform and Non-uniform Quantization, Compading Characteristics, Encoding, Bandwidth and Noise in PCM Systems, Differential PCM, Delta modulation and Adaptive DM.

Unit IV: Laboratory Work

Study of ICs (AD633/AD734), Design and realize AM modulator using Square Law modulator and calculate its modulation index and power, design and realize AM detector using Square Law detector and Envelope detector, design and realize DSB-SC signal Modulator using Analog Multiplier, design and realize DSB-SC signal demodulator using Coherent detection and Squaring loop, Simulation of SSB-SC modulator and demodulator using MATLAB/Simulink, Simulation of Hilbert transformer and VSB filter using MATLAB/Simulink. Derivation of modulation index in case of FM signal, to design and realize FM generation and Detection, To study & realize Op-amp based Pre-Emphasis & De-Emphasis circuits. Field study/visit to place such as Radio Kashmir Srinagar

Books Recommended:

1. Modern Digital and Analog Communication Systems, by B. P. Lathi, Oxford Press.
2. George Kennedy, "Electronic Communication System", McGraw- Hill.
3. Gary M. Miller and Jeffery S. Beasley, "Modern Electronic Communications ", PHI.
4. Simon Haykin, "Communication Systems", 8th edition, Wiley Publishers.
5. Wayne Tomasi, "Electronics Communication systems", 4th edition, Pearson Publishers.

Semester - II

ELE19202C: Microprocessor Architecture and Programming **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To introduce 8086 architecture and programming in assembly language.
- To introduce the basic concepts of interfacing memory and peripheral devices to a processor.
- To acquaint students with the concept of interrupts and interrupt service routine (ISR).

Learning Outcomes

After studying the course, the students shall be able to:

- Gain thorough understanding of the core ideas and architecture of the 8086 Microprocessor.
- Understand many addressing modes that the 8086 microprocessor supports.
- Use the instruction set 8086 to create programs in assembly language.
- Demonstrate mastery of interrupts, procedures, and interrupt service subroutines.
- Analyse both minimum and maximum mode 8086 systems and gain the practical skills to interface the 8086 Microprocessor with peripheral devices, including memory, I/O devices, and display units.

Detailed Syllabus:

Unit I: Architecture, Addressing Modes, Instruction Set and ALP

Introduction to 8086 Microprocessor, Architecture of 8086 Microprocessor, Functions of BIU and EU, working of 8086 Microprocessor, Registers of 8086 Microprocessor and their purpose, Addressing Modes of 8086 microprocessor, Memory Segmentation in 8086 Microprocessor based system. Introduction to Programming, Various level of Programming, Assembly language programming, Assembler, Linker, Debugger, Instruction set of 8086 Microprocessor, Data transfer instructions, Arithmetic and Logical instructions, Branch Instructions, Processor control instruction, String operation instructions. Assembly language Programming for 8086 microprocessors. Use of Macros in ALP.

Unit II: Interrupts, Timing and Peripheral Devices

Introduction to procedures, interrupts and interrupt service subroutines, 8086 Interrupt Structures, Interrupt Vector table, various types of Interrupts, Software Interrupts, Hardware Interrupts, Multiple Interrupts, Input /Output structure, ALP using interrupts, Device Access, Operating Systems Calls, BIOS Calls and Direct Device Access, 8259 Programmable Interrupt Controller-Features, Interfacing & Programming, Various Types of 8086 microprocessor, Architecture and operation of 8284A Clock Generator, Buffering and Latching of 8086 Microprocessor, Bus timings, Timing Diagrams, Wait States, Minimum Mode 8086 System, 8288 Bus Controller, Maximum Mode 8086 System.

Unit III: Peripheral Devices and Interfacing

Peripheral Devices and Interfacing, Introduction to memory and its types, Memory interfacing, Memory mapped and I/O Mapped Schemes, Even and Odd Addressing. Data Transfer Schemes, I/O Interfacing, Isolated and Memory Mapped I/O instructions, Ports. Study of Peripheral chips: Features, Block Diagram, Control & Status Registers, Operating Modes, Interfacing & Programming of 8255 Programmable Peripheral Interface, 8257 Programmable DMA controller, 8254 Programmable Interval timer, Introduction to DAC0830 Digital to Analog Converters, ADC0804 Analog to Digital Converters, 8279 Keyboard and Display Controller, 8251/16550 (USART), and 8087 Co-processor. Various emerging trends in Microprocessor Design.

Unit III: Laboratory Work
The Laboratory work shall be based on units I through III consisting of Assembly Language Programming and interfacing using Assemblers, simulators and trainers.

Books Recommended:

1. Introduction to 8086, 80186, 80286, 80386, 80486, Pentium and Pentium Pro Processors, B. Bray, Tata McGraw Hill Publishing Company.
2. Microprocessor Theory and Applications, M. Rafiq-u Zaman, McGraw Hill Publishing Company.
3. Microprocessor and x86 Programming, V. R. Venugopal, McGraw Hill Publishing Company.
4. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Application by W. A. Treibel and Avtar Singh, Prentice Hall.
5. Microprocessors and Interfacing Programming and Hardware, D. Hall, TMG.
6. Microprocessor 8086 Architecture, Programming and interfacing by Sunil Mathur. PHI.

Semester - II

ELE19203C: Power Electronic Circuits and Systems **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To get an overview of power electronics
- To provide the students deep insight into the working of different switching devices with respect to their characteristics.
- To learn about different power transistors such as BJTs, IGBTs, MOSFETs, SITs etc.
- To analyze different regulators, converters and inverters.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Gain a thorough understanding of both the theoretical foundations and real-world applications of Powe electronic devices.
- ➢ Perform the design and analysis of various electrical switches, understand the behaviour of thyristors, of power diodes and BJTs.
- ➢ Understand the principles and uses of inverters and cyclo-converters, as well as the design of converters, including BUCK, BOOST, BUCK–BOOST, and other variants.
- ➢ Understand commutation approaches, design converters, and experimentally validate device properties through practical laboratory work, ensuring a well-rounded skill set for handling real-world power electronic difficulties.

Detailed Syllabus:

Unit I: Introduction to Power Devices and Converters
Review of switching characteristics of Power diodes, BJT's), Characteristics of an ideal switch, Types of electronic switches. Thyristor construction and characteristics, Methods of turning ON, Turn-off, effect of high di/dt and dv/dt, Snubber circuits, Gate triggering circuits, Device specifications and ratings, DIAC, TRIAC , Controlled rectifiers, AC voltage controllers, Principle of ON- OFF control, Principle of phase control, Single phase bi-directional controllers with resistive loads, Natural commutation, Impulse commutation, complementary commutation, external pulse commutation, Load side and line side commutation, Series and Parallel combination of SCRs.

Unit II: Regulators, Inverters and Cyclo-converters
Principle of step down and step up operation, Performance parameters of DC-DC converters, Design of BUCK converters, BOOST converters, BUCK–BOOST converters, Forward converter, Half-Bridge converter and Full Bridge converter. Inverter: Principle of operation, performance parameters, Pulse width modulation techniques, Design of inverters, Single-phase half bridge inverter, Single phase full bridge inverter, Analysis in each case (for

resistive and inductive loads), Cyclo-converters: step up and step down, design of single-phase step down Cycloconverters, Power supplies: SMPS, UPS.

Unit III: Laboratory Work

Verify switching action of a Power BJT and MOSFET, IV characteristics of SCR, DIAC, TRIAC and UJT. Calculation of Holding and latching currents of SCR, To study various Commutation Techniques, Design of BUCK, BOOST and BUCK-BOOST converter.

Books Recommended:

1. Power Electronics, Circuits, Devices and Applications by M. H. Rashid, PHI.
2. Power Electronics by Mohan, Undeland, Robbins, John Wiley and Sons.
3. Power Electronics by P. C. Sen, Tata McGraw Hill, Pub. Co.
4. Introduction to Thyristors and their Applications, by M. Ramamorty .

Semester - II

ELE19204C: Microwave Engineering **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To understand and gain complete knowledge about microwave devices and components.
- To learn about transmission lines and analysis of wave guides.
- To learn the importance of S parameters and VSWR in microwave measurements.

Learning Outcomes

After studying the course, the students shall be able to:

- Attain a thorough knowledge of microwave devices and components, including microwave tubes like klystrons, reflex klystrons, and the Gunn oscillator.
- Master the analysis of microwave transmission lines, covering distributed parameters, characteristic impedance, propagation constants, and reflection/transmission coefficients.
- Understand the fundamentals of microwave waveguides, specifically rectangular waveguides and their TE/TM modes.
- Learn the importance of S parameters and VSWR in microwave measurements. Understand their role in characterizing the performance of microwave devices and systems.
- Gain practical experience in the laboratory by studying microwave guide components, determining frequency and wavelength in rectangular waveguides, measuring standing wave ratio and reflection coefficients, and using the Smith chart for impedance matching.
- Perform experiments with Gunn diodes, Magic Tee, and Klystron tubes, including electronic tuning range determination.
- Utilize simulation tools such as CST to complement theoretical concepts, allowing for a deeper understanding of microwave principles and their practical applications.
- Perform various experiments using CST Tool for a comprehensive learning experience.

Detailed Syllabus:

Unit I: Microwave Transmission Lines and Wave Guides

Transmission Line and Distributed parameters, Basic Transmission line equations, Solutions, Distortions in Transmission line, Condition for Distortion less line, Characteristic impedance, Propagation Constant, Reflection and Transmission coefficients, Standing wave and Standing wave ratio, Fundamentals of Microwave Waveguides, Rectangular Waveguides, TE & TM modes in Rectangular magnitudes, S- Matrix.

Unit II: Microwave Devices

Microwave tubes, Klystrons: Multi-cavity Klystron and Reflex Klystron, Gunn Oscillator, Introduction to the Strip Lines: Micro Strip and Parallel Lines.

Unit III: Laboratory Work
Study of different Microwave guide components, determination the frequency and wavelength in a rectangular wave guide working on TE 10 mode, Finding the standing wave ratio and reflection coefficient. Measurement of an unknown impedance with smith chart, VI characteristics of Gunn diode, O/P power and frequency as a function of voltage in case of Gunn diode, Magic tee, Characteristics of Klystron tube and determination of its electronic tuning range, various experiments using CST Tool.

Books Recommended:
1. Microwave Devices and circuits by Samuel Y. Liao
2. Microwave Principles By Herbert J. Reich
3. Foundations for Microwave engineering by Robert E. Collin
4. Elements of Engineering Electromagnetics by Nannapaneni NarayanaRao
5. Electromagnetic Field theory by Rishabh Anand

Semester - II

ELE19205DCE: VLSI Technology **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
4	0	0	4	20	80	0	100	2 ½ Hours

Learning Objectives:
- To grasp the basic theoretical & mathematical concepts of various steps involved in the fabrication of an integrated circuit using BJT/MOS technology.

Learning Outcomes
After studying the course, the students shall be able to:
- Understand the various terms and concepts of IC technology.
- Develop understanding about the various steps involved in the fabrication of an integrated circuit using BJT/MOS technology.
- Identify the various IC fabrication methods.
- Apply the technology scaling concepts in device fabrication.

Detailed Syllabus:
Unit I: Crystal Growth and Epitaxy
Crystal Growth and Wafer Preparation, Electronic grade Germanium and Silicon, Zone melting process of purification, Simple purification process, Czhrolaski method. Epitaxy, Vapor phase epitaxy, Transport process and Reaction kinetics, Molecular beam Epitaxy process.

Unit II: Diffusion Technology
Fick's one-dimensional diffusion equation. Diffused layers, Pre-deposition step, Drive-in diffusion with expression, Field aided diffusion, Diffusion system, C-V technique for profile measurement, Junction depth and sheet resistance measurement.

Unit III: Oxidation and Lithography
Oxidation Techniques, Growth mechanism and Kinetics of Oxidation layers, Oxidation techniques and Systems. Lithography, Lithography process and Types of Lithography, Optical Lithography, Contact proximity and projection Lithography techniques, Resists, Electron beam Lithography, Electron Resists.

Unit IV: Etching, Metallization and IC Fabrication
Etching, Subtractive and Additive method of pattern transfer, Resolution and edge profiles in Subtractive pattern transfer, Selectivity and feature size control of an etching process. Contacts (Ohmic and rectifying), Physical vapor deposition, Methods of physical vapor deposition, Resistance heated evaporation, Electron beam evaporation, Thickness measurement and monitoring. Basic consideration for IC processing and Packaging, Modern IC fabrication.

Books Recommended:
1. S. M. Sze, VLSI Technology, Mcgraw Hill Publishing Company.
2. Azeroff and Brophy, Electronic Processes in Semiconductors, McGraw Hill Publishing company.
3. A. S. Grove, Physics and Technology of Semiconductor Devices, John Wiley and Sons, New York.

4. Ben G. Streetman, Solid State Electronic Devices, Prentice Hall of India Ltd, N. Delhi.

Semester - II								
ELE19206DCE: CMOS VLSI and Nano-Electronics –II (Digital IC Design)							Course Category: DCE	
Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To study the quality metrics of digital design.
- To acquaint the students with various techniques of digital design
- To discuss about the issues of digital IC design and their solutions.
- To acquaint the students with the design of higher order digital systems.

Learning Outcomes

After studying the course, the students shall be able to:

- Explain the basics of MOS devices, DC transfer characteristics and tristate inverters.
- Design CMOS inverters with specified noise margin and propagation delay.
- Design and analyse the various logic circuit layouts for both static and dynamic CMOS circuits
- Analyse, design, optimize and simulate digital circuits using CMOS constrained by the design metrics.
- Connect the individual gates to form the building blocks of a system.
- Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
- Design combinational and sequential circuits meeting time constraints.
- Design memories with efficient architectures to improve access times, power consumption.
- Use EDA tools like Cadence, Mentor Graphics and other open-source software tools like Ngspice.

Detailed Syllabus:

Unit I: Introduction to CMOS and Combinational Logic Design

Digital IC, Digital Combinational and sequential circuit, issue in digital IC design, Quality, metrics of Digital Design, Review of CMOS. Static C-MOS Inverter and its characteristics, CMOS Design Consideration Transistor Sizing, Power Dissipation, Design Margining, Ratioed Logic, Pass Transistor Logic.

Unit II: Dynamic CMOS design and Sequential Logic Design

Dynamic CMOS design, basic principle, speeds and power Dissipation of Dynamic Logic, Signal Integrity in Dynamic Design, Cascaded Dynamic. Static Latches and registrars, Dynamic Latches and Registers, Alternative Register Styles, Pipelining.

Unit III: Memory Design and Implementation Strategies for Digital ICS

Memory Classification, Memory Architecture and Building Block, Read only Memories, Nonvolatile Read Write Memories, Read-Write Memories, Memory Peripheral Circuit Custom, Semi-custom Circuit Design, Cell–Based Design Methodology, Array Based Implementation Approach**,** Layout Introduction to PLA, PAL, CPLD, FPGA.

Unit IV: Laboratory Work

The laboratory work shall include minimum 10 practicals on Digital design including combinational (Static and Dynamic) and sequential circuits, Memory and Programmable logic devices.

Books Recommended:

1. J. M. Rabaey, A. Chandrakasan and B. Nikolic: Digital Integrated Circuits- A Design Perspective, 2nd ed., PHI, 2003
2. D. A. Pucknell and K. Eshraghian, Basic VLSI Design, PHI, 1995
3. N.H.E. Weste and K. Eshraghian, Principles of CMOS VLSI Design - a System Perspective, 2nd ed., Pearson Education Asia, 2002
4. S.M. Kang and Y. Leblevici, CMOS Digital Integrated Circuits Analysis and Design, 3rd ed., McGraw Hill, 2003
5. J. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons (Asia) Pte Ltd, 2002

R. Jacob Baker, CMOS Circuit Design, Layout, and Simulation, IEEE Press, 1997

Semester - II								
ELE19207DCE: Optical Communication and Networks							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To learn the basic elements of optical fiber transmission link.
- To study various optical network operations.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand Optical Fiber Transmission and develop a foundational understanding of optical communication systems.
- Gain proficiency in the operation of optical sources and detectors such as LEDs and lasers.
- Study WDM concepts, passive optical components like couplers and circulators, and devices such as fiber grating filters.
- Explore network concepts, topologies, and examples of WDM implementation.
- Explore various optical network operations, including PON, IP over DWDM, and Optical Ethernet.
- Understand fundamental receiver operation, digital signal transmission, and error sources in optical networks.
- Apply theoretical knowledge in a laboratory setting using an OFC training kit.
- Perform experiments related to multiplexing, point-to-point links, system considerations, fiber dispersion in multi-mode and single-mode fibers, transmission distance, line coding, and the measurement of attenuation and dispersion.
- Develop practical skills in designing optical links, considering overall fiber dispersion, and implementing line coding.
- Learn to analyse the eye pattern, a crucial aspect of optical link performance, and understand the factors affecting transmission quality.

Detailed Syllabus:

Unit I: Optical Fibres and Links

Introduction to Optical Communication Systems; Optical fibers, light propagation through fibers, mode theory, attenuation, dispersion, characteristics of single mode fibers sources and detectors; LED's and lasers, Point to point links, power links, error control, coherent detection, differential quadrature phase shift keying (QPSK).

Unit II: WDM

Overview of WDM, Passive optical couplers, isolators and circulators, fiber grating filters, phase array based devices, network concepts, network topologies, WDM examples.

Unit III: Optical Networks

Passive Optical Networks, IP over DWDM, Optical Ethernet Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit

Unit IV: Laboratory Work

To perform various experiments using OFC training kit, Multiplexing, Point-to- point links, System considerations, Overall fiber dispersion in Multi-mode and Single mode fibers, Transmission distance, Line coding in Optical links, Measurement of Attenuation and Dispersion, Eye pattern.

Books Recommended:

1. Microwave Principles by Herbert J. Reich, East- West Press.
2. Antenna and Wave Propagation by A.K. Gautam.
3. Modern Electronic Communications by Jeffrey S. Beasley, PHI.
4. Lasers and Optical Fibre Communications by P. Sarah International Publishing House.

Semester - II

ELE19208DCE: Design and Analysis of Active Filters **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To introduce to students, the importance and applications of filters.
- To introduce basic theory and analysis of filters.
- To acquaint the students with the design of active filters.
- To understand the importance of operational transconductance amplifiers (OTA) and realization of active filters using OTA.

Learning Outcomes

After studying the course, the students shall be able to:

- Identify the importance and applications of filters.
- Understand the basic theory and analysis of filters.
- Design the active filters with different approximations.
- To understand the importance of operational transconductance amplifiers (OTA) for the realization of active filters.
- Learn the design of active filters using switched capacitor technique.

Detailed Syllabus:

Unit I: Filter Approximation Models and Sensitivity Analysis

Introduction to Analog filter theory, filter approximations, Butterworth approximation, Chebyshev approximation, Bessel filters, frequency transformations, lowpass-lowpass, lowpass- highpass, lowpass-bandpass and low-pass - band reject transformations.

Unit II: Operational Transconductance Amplifiers, Sensitivity and Active filter Synthesis

Operational Transconductance Amplifier (OTA), Circuit Descriptions of OTA, Advantages, limitations. Elementary Transconductor Building Blocks: Resistor, Integrator, Amplifier, summers, gyrators and Modulators. First and Second order Filters, High-order filters, Sensitivity study, Sensitivity function, magnitude and pass sensitivities, single parameter sensitivity, multiple parameter sensitivity. Cascade approach, Simulated Inductance Approach, Operational Simulation of LC ladders and FDNR approach. Immitance converters and inverters, Generalized Impedance converter.

Unit III: Switched Capacitor filters

The MOS switch, The Switched capacitor/resistor equivalence, analysis of switched capacitor filter using charge conservation equations, First-order building blocks (Inverting and Non-inverting Amplifier, Integrator and Differentiator), Sampled-Data operation, Switched capacitor First and Second order Filters, Switched capacitor High-order filters.

Unit IV: Laboratory Work

The laboratory work shall include minimum 10 practicals on filter synthesis, operational transconductance amplifier and switched capacitor filters.

Books Recommended:

1. Kendall Su, Analog Filters, Second Edition, Kluwer Academic Publishers, 2002

2. Larry D. Paarmann, Design and Analysis of Analog Filters: A Signal Processing Perspective, Kluwer Academic Publishers, 2003.
3. M. E. van Valkenburg and Rolf Schumann, Analog Filter Design, Oxford University Press, 2005.
4. Mingliang Liu, Demystifying Switched-Capacitor Circuits, Newnes, Elsevier, 2006.

Semester - II

ELE19209DCE: Simulation and Modeling using MATLAB **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:
- To familiarize the students with MATLAB software.
- To provide a foundation in use of this software for real time applications.
- To enable the student on how to approach for solving problems using simulation tools.

Learning Outcomes
After studying the course, the students shall be able to:
- Understand the main features and significance of MATLAB.
- Employ this powerful tool to simulate and solve problems in the realms of electrical and electronic applications.
- Interpret models and effectively apply the results to address critical challenges in real-world environments.
- analyse of output data generated by models, enabling them to assess the validity of their simulations.
- design and evaluate the complex systems and processes, showcasing their ability to leverage MATLAB as a versatile and integral tool for problem-solving and decision-making in diverse contexts.

Detailed Syllabus:
Unit I: Introduction to MATLAB
Introduction, MATLAB Windows, Types of Files, Constants, Variables and Expressions; Character Set, Data Types, Operators, Built-in Functions, Vectors and Matrices; Matrix Manipulations, Matrix and Array Operations, Control Structures; Loops and Branch Control Structures.
Unit II: MATLAB Editor and MATLAB Graphics
MATLAB Editor, Creating M-Files, Function Subprograms, Types of Functions, Function Handlers, Errors and Warnings, MATLAB Debugger, Two- Dimensional Plots, Multiple Plots, Subplots, Specialized Two-Dimensional Plots, Three-Dimensional Plots

Unit III: Data and Image Visualization in MATLAB
Understanding Color maps, Using Color to Describe a Fourth Dimension, Image Data Matrices, Image Formats, Image Files, Image Utilities, Reading and Displaying Image, Image Compression, Image Denoising, Image Filtering, Introduction to Movies and Sound in MATLAB.
Unit IV: Simulink Basics
Starting Simulink, Simulink Modeling, Solvers, Data Import/Export, State-Space Modeling and Simulation, Simulation of Non-Linear Systems, Creating a random bit stream System objects and their benefits, Modulating a bit stream using Digital Modulation Techniques, Applying pulse-shaping to the transmitted signal, Modeling a QPSK receiver for a noiseless channel, Computing bit error rate.
A minimum of 20 programs to be simulated on MATLAB software across all the four units.
Books Recommended:
1. P.A. Rajammal*, "A handbook of Methodology of Research",* Vidyalaya Press, 1976.
2. BuaneHanselman, Bruce Littlefield, *"Mastering MATLAB 7",* Pearson, 2013
3. Agam Kumar Tyagi*, "MATLAB and Simulink for engineers",* 2nd Edition, 2012.
4. Raj Kumar Bansal*, "MATLAB and its Applications in Engineering"*, Pearson, 2009.

Semester - II								
ELE19210DCE: Wireless Adhoc and Sensor Networks							Course Category: DCE	
Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To learn basic concepts related to WSN.
- To provide insight of various WSN designs and emphasize their differences with other communication networks.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the WSN Concepts and develop a solid grasp of WSN by comprehending basic concepts, including wireless network architecture, switching technology, and standards.
- Differentiate WSNs from other communication networks.
- Understand the intricacies of Ad Hoc Wireless Networks, including MAC protocols, transport protocols, and security issues.
- Explore the design goals and challenges specific to MAC and routing protocols in ad hoc wireless environments.
- Understand the sensor networks, focusing on the basics of wireless sensors, their applications, and design considerations.
- Apply theoretical knowledge through laboratory work involving hardware studies and simulations.
- Develop proficiency in sensor network hardware components, operating systems and imperative and dataflow style languages.
- Gain practical experience with node-level simulators such as ns-2 and TOSSIM, enhancing skills in hardware implementation and simulation-based analysis.

Detailed Syllabus:

Unit I: Introduction

Wireless Network, Wireless Network Architecture, Wireless Switching Technology, Wireless Communication problem, Wireless Network Reference Model, Wireless Networking Issues & Standards. Wireless LAN (Infrared Vs radio transmission, Infrastructure and Ad-hoc Network, IEEE 802.11: System Architecture, Protocol Architecture, 802.11b, 802.11a)

Unit II: Ad Hoc Wireless Networks (Transport Protocols and Security)

Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless Internet, MAC protocols, Issues in Designing a MAC Protocol for Ad hoc Wireless Networks, Design Goals for a MAC Protocol for Ad hoc Wireless Networks, TCP over Ad hoc Wireless Networks, Classifications of the MAC Protocols, Other MAC Protocols. Routing Protocols, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks, Classifications of Routing Protocols. Secure Routing in Ad hoc Wireless Networks

Unit III: Sensor Networks

Basics of Wireless, Sensors and their Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications Data Retrieval in Sensor Networks: Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs. Sensor Network Hardware: Components of Sensor Mote, Operating System in Sensors– TinyOS, LA-TinyOS, SOS, RETOS Imperative Language: nesC, Dataflow style language: TinyGALS, Node-Level Simulators, ns-2 and its sensor network extension, TOSSIM.

Unit IV: Laboratory Work

The laboratory work shall be based on unit I through unit IV and shall use hardware study as well as experiments using simulations.

Books Recommended:

1. Adhoc Wireless Networks – Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education.
2. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications / Cambridge University Press.
3. Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group.
4. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers.
5. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group.

Semester - II

ELE19211DCE: Communication Hardware Design **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand the building blocks of communication systems.
- To study and design phase locked loop, frequency synthesizers, mixers and high frequency amplifiers.

Learning Outcomes

After studying the course, the students shall be able to:

- Develop a thorough understanding of the fundamental building blocks of communication systems, including noise representation, broad-banding techniques, and high-frequency amplifier and oscillator design principles.
- Design high-frequency amplifiers and oscillators by reviewing noise in electronic networks, implementing input compensation, feedback, and employing various amplification techniques.
- Design PLL and their applications.
- Understand the linear model of PLL, phase detectors, voltage-controlled oscillators, and loop filters.
- Gain expertise in frequency synthesizers, covering direct frequency synthesis, phase-locked frequency synthesis, and the impact of reference frequency on loop performance.
- Develop skills in frequency mixer design, including switching types, square law mixers, and balanced modulator ICs. Study the performance of mixers, and explore high-efficiency amplifier design principles, including class C power amplifiers, frequency multiplication, and different amplifier classes such as Class D, E, and S.

Detailed Syllabus:

Unit I: Design of High Frequency Amplifier and Oscillators

Review of Noise in Electronic Networks; Network Noise Representation, Broad Banding Techniques - Input Compensation, Feedback, Lossless Feed-back Amplifiers, Neutralization, Cascode Amplifiers; Theory of Automatic Gain Control; AGC System Components; Design Examples; High Frequency Oscillator Circuits; Amplitude and Phase Stability; Parallel Mode and Series Mode Crystal Oscillators; Voltage Control Oscillators; Design Examples.

Unit II: Phase Locked Loop (PLL) and Their Applications

Introduction; Linear Model of the Phase Locked Loop, Phase Detectors, VCOs and Loop Filters Design Examples and Applications; Tracking Filters; Angle Modulation: Frequency Demodulation, Amplitude Demodulation; Phase Shifters; Signal Synchronizers; Costas Loop; Digital Phase Lock Loop.

Unit III: Frequency Synthesizers

Introduction; Direct Frequency Synthesis; Frequency Synthesis by Phase Lock; Effect of Reference Frequency on Loop Performance; Variable Modules Dividers; Methods for Reducing Switching Time; Direct Digital Synthesis; Synthesizer Design Examples; Output Noise Considerations.

Unit IV: Mixers, High Efficiency Amplifiers

Frequency Mixers; Switching Type; Mixers and Their Performance; Square Law Mixers; BJT and FET Mixers;

Balanced Modulator ICs, Class C Power Amplifier Design; Frequency Multiplication; Class D, E and S Amplifiers; Modulators and Amplifiers Using Vacuum Tubes and Power Electronic Devices.

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. J. Smith, Modern Communication Circuits, McGraw Hill Book, 1996.
2. D. Roddy& J. Coolan, Electronic Communication, Prentice Hall of India, New Delhi, 1987.
3. Sidney Soclof, Applications of Analog ICs, Prentice Hall of India, New Delhi, 1990.

Semester - II

ELE19005GE: Optical Fiber Communication **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To get basic knowledge of optical fibers and links.
- To get an overview of WDM and optical networks.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire basic knowledge of optical fibers and links, including an understanding of light propagation through fibers, mode theory, attenuation, dispersion, and the characteristics of single-mode fibers. Gain insights into optical sources such as LEDs and lasers.
- Develop an overview of WDM technology, covering passive optical components like couplers, isolators, and circulators, as well as fiber grating filters. Understand different network topologies and explore examples of WDM implementation.
- Gain insights into optical networks, including passive optical networks, IP over Dense Wavelength Division Multiplexing (DWDM), and Optical Ethernet.
- Understand fundamental receiver operation in optical communication systems.
- Understand the practical application of passive optical components and their role in enhancing the efficiency of optical networks.
- Develop a practical understanding of fundamental receiver operation in optical communication systems.

Detailed Syllabus:

Unit I: Optical Fibers and Links

Introduction to Optical Communication Systems; Optical fibers, light propagation through fibers, mode theory, attenuation, dispersion, characteristics of single mode fibers sources and detectors; LED's and lasers.

Unit II: WDM and Optical Networks

Overview of WDM, Passive optical couplers, isolators and circulators, fiber grating filters, network topologies, WDM examples. Passive Optical Networks, IP over DWDM, Optical Ethernet Optical receiver operation- Fundamental receiver operation.

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. Microwave Principles by Herbert J. Reich, East- West Press.
2. Antenna and Wave Propagation by A.K. Gautam.
3. Modern Electronic Communications by Jeffrey S. Beasley, PHI.
4. Lasers and Optical Fibre Communications by P. Sarah International Publishing House.

Semester - II

ELE19006GE: System Simulation using MATLAB **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To familiarize the students with MATLAB software.
- To provide a foundation in use of this software for real time applications.
- To enable the student on how to approach for solving problems using simulation tools.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand MATLAB software, establishing a solid foundation for its application in real-time scenarios.
- Gain the capability to utilize this software effectively, providing them with essential skills to tackle real-world applications.
- Comprehend problem-solving approach using simulation tools, enabling them to address diverse challenges in their respective fields.
- Apply random numbers and various variables to construct simulation models, showcasing their ability to employ MATLAB for dynamic and nuanced problem-solving in a variety of contexts.

Detailed Syllabus:

Unit I: Introduction to MATLAB

Introduction, MATLAB Windows, Types of Files, Constants, Variables and Expressions; Character Set, Data Types, Operators, Built-in Functions, Vectors and Matrices; Matrix Manipulations, Matrix and Array Operations, Control Structures; Loops and Branch Control Structures, MATLAB Editor, Creating M-Files, Function, Subprograms, Types of Functions, Two- Dimensional Plots, Multiple Plots, Subplots, Specialized Two-Dimensional Plots, Three-Dimensional Plots.

Unit II: Data and Image Visualization in MATLAB

Image Data Matrices, Image Formats, Image Files, Image Utilities, Reading and Displaying Image, Image Compression, Image De-noising, Image Filtering, Introduction to Simulink: Starting Simulink, Simulink Modeling, Solvers, Data Import/Export, State-Space Modeling and Simulation.

To perform at least 10 experiments using software on theory part of the syllabus.

Books Recommended:

1. P.A. Rajammal, "A handbook of Methodology of Research", Vidyalaya Press, 1976.
2. BuaneHanselman, Bruce Littlefield, "Mastering MATLAB 7", Pearson, 2013
3. Agam Kumar Tyagi, "MATLAB and Simulink for engineers", 2nd Edition, 2012.
4. Raj Kumar Bansal, "MATLAB and its Applications in Engineering", Pearson, 2009.

Semester - II

ELE19007GE: Data Structures **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To learn efficient storage mechanisms of data for an easy access.
- To design and implement various basic and advanced data structures.
- To improve the logical ability.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the Fundamentals of Data Structures.
- Perform the analysis of Data Structures.
- Perform the selection of Data Structures.
- Perform the implementation of Data Structures.
- Do operations on Data Structures.

Detailed Syllabus:

Unit I: Lists, Stacks and Queues

Lists, Abstract Data Type-List, Array Implementation of Lists, Linked Lists, Doubly Linked Lists, Circularly Linked - Implementation and Applications. Stacks, Abstract Data Type-Stack, Implementation of Stack, Implementation of Stack using Arrays, Implementation of Stack using Linked Lists, Applications. Queues Abstract Data Type-Queue, Implementation of Queue, Array Implementation, Linked List Implementation, Implementation of Multiple Queues, Implementation of Circular Queues, Array Implementation, Linked List Implementation of a circular queue, Implementation of DEQUEUE, Array Implementation of a de-queue, Linked List Implementation of a de-queuer.

Unit II: Searching, Sorting and Advanced Data Structures

Linear Search, Binary Search, Applications. Internal Sorting, Insertion Sort, Bubble Sort, Quick Sort, 2-way Merge Sot, Heap Sort, Sorting on Several Keys.

Books Recommended:

1. Tenenbaum, Data Structures through C
2. Weiss, Data Structures and Algorithms in C++
3. SamiranChattopadhy, Data Structures through C Language
4. Patel, Data Structures with C
5. Wiener and Pinson, Fundamentals of OOPS and Data Structures in Java

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Semester - II

ELE19008GE: Wireless Sensor Networks **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To learn basic concepts related to WSN.
- To provide insight of various WSN designs and emphasize their differences with other communication networks.

Learning Outcomes

After studying the course, the students shall be able to:

- Explore wireless LANs, ad-hoc network issues, and the design of MAC protocols. T
- Understand wireless sensor networks, addressing basics, design considerations, clustering, and applications.
- Understand both the intricacies of ad-hoc wireless networks and the key elements of sensor networks, preparing them to design and implement wireless communication systems.

Detailed Syllabus:

Unit I: Introduction to Adhoc Wireless Networks

Wireless Network, Wireless Network Architecture, Wireless Switching Technology, Wireless Communication problem, Wireless Network Reference Model, Wireless Networking Issues & Standards. Wireless LAN (Infrared vs radio transmission, Infrastructure and Ad-hoc Network, Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless Internet, MAC protocols, Issues in

Designing a MAC Protocol for Ad hoc Wireless Networks.

Unit II: Sensor Networks

Basics of Wireless, Sensors and their Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy consumption, Clustering of Sensors, Applications Data Retrieval in Sensor Networks: Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs. Sensor Network Hardware: Components of Sensor Mote, Operating System in Sensors– TinyOS, LA-TinyOS, SOS, RETOS.

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. Adhoc Wireless Networks – Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education.
2. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal, World Scientific Publications / Cambridge University Press.
3. Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group.
4. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers.

Semester - II

ELE19003OE: Computing and Informatics - II **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To familiarize students with automation tools.
- To enable students to work with documents, spreadsheets and presentations.

Learning Outcomes

After studying the course, the students shall be able to:

- Apply advanced data analytics techniques to extract meaningful insights from complex datasets.
- Understand the automation tools.
- work with documents and explore other relevant applications of Microsoft Office
- Analyse and design advanced algorithms for optimization, graphical representation, and computational complexity.
- Implement solutions for managing and analysing large-scale datasets.
- Demonstrate research skills and engage in critical analysis of existing research literature in computing informatics.

Detailed Syllabus:

Unit I: Introduction

Introduction to office automation tools (MSWord, PowerPoint, Excel), Create and edit the document, profiling tools, formatting documents, using templates, wizards and charts and objects, custom styles and pagination. Spreadsheet creation, addressing, formula editing, sorting and filtering, toolbars. Introduction to PowerPoint presentation, templates, layouts and formatting.

Unit II: Laboratory Work

Working with Documents, Formatting Documents, Setting Page style, Creating Tables, Mail merge, Templates. Working with spreadsheets, formatting, insertion, deletion and organization of worksheets. Creating a presentation, formatting a Presentation, Adding Effects to the Presentation, Printing Handouts.

Books Recommended:

1. Archana Kumar "Computer Basics with Office Automation" 1st Edition I. K. International Publishing House.
2. Rohit Khurana "Learning Ms-Word and Ms-Excel" APH Publishing Corporation.
3. AnitalGoel "Computer Fundamentals" Pearson.

Semester - II

ELE19004OE: Electronic Devices & Circuits - II | **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To acquire knowledge regarding measuring instruments and power supply.
- To study basics of transducers and its types.

Learning Outcomes

After studying the course, the students shall be able to:

- Identify the different types of measuring equipment.
- Use the measuring equipment in different applications.
- Design regulated power supply.
- Identify different types of sensors and their applications.
- Know the theory of operation of sensors.

Detailed Syllabus:

Unit I: Measuring Instruments and Power Supply

Measurement: Meter, Ammeter, Voltmeter, Ohmmeter, Multimeter, Introduction to Cathode Ray Oscilloscope (CRO) and Function Generator.

Power supply. AC/DC Voltage/Current, Unregulated and regulated power supplies, introduction to IC based regulated power supplies. Study of 78XX and 79 XX series. SMPS Power Supply, DC/AC Inverters, working principle. UPS. Typical Public Address system.

Unit II: Transducers

Transducer: Sensors and actuators; Properties of a sensor; Resistive, capacitive and inductive sensors, Pressure Sensor; Temperature Sensor; Photo Sensor; Humidity Sensor, Gas Sensor; Applications of sensors.

Lab Work:

- Amplitude, Time period, frequency, phase measurements using CRO.
- Testing the characteristics of resistor, capacitor, inductor, diode on CRO.
- Testing of 7805/12/15 IC
- Testing of 7905/12/15 IC
- Testing of Temperature sensor.
- Testing of Photo sensor.

Books Recommended:

1. Instrumentation and Measurements by A. K. Sawhney
2. Electronic Instrumentation by Bell.

Semester - III

ELE19301C: Physics of Semiconductor Devices **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
4	0	0	4	20	80	0	100	2 ½ Hours

Learning Objectives:

- To establish solid understanding of crystal structure and semiconductor devices.
- To understand the basic physics governing the semiconductors.
- To acquaint the students with the general understanding of analyzing a semiconductor device.
- To analyze BJT, FET and MOSFET for their comparative analysis.
- To study the physics and operation of high frequency devices.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the basic physics of semiconductor devices and the basics theory of PN junction.
- Understand the basic theory of Bipolar Junction Transistor.
- Understand the basic theory of Field Effect transistors.
- Understand the basic theory of MOS transistors.
- Understand the basic theory of microwave devices.
- Understand the basic theory of optoelectronic devices.

Detailed Syllabus:

Unit I: Solid-state Materials, Crystal Structure and Carrier Transport

Introduction to solid-state materials-optical and thermal properties, Crystal Structure: Space lattices, Primitive and Unit Cell, Index system for crystal planes, Separation between the parallel planes of a cubic crystal, Description of Schrodinger wave equation: Physical interpretation of wave function, Kroning Penney Model, K-space diagram, Effective mass, Concept of Hole, Derivation of Density of state functions, Fermi-Dirac Distribution function, Carrier concentration at thermal equilibrium, Carrier transport Equation, Decay of photo excited carriers, carrier lifetime, Hall effect.

Unit II: Semiconductor Diodes

Semiconductor junctions: Homo and hetero Junction, Abrupt and Graded junction, P-N Junction: depletion region, diffusion, generation-recombination, Current-Voltage characteristics of PN junction, Depletion capacitance, Diffusion capacitance, Junction breakdown phenomenon, Metal-Semiconductor Contacts: equilibrium, idealized metal semiconductor junctions, non-rectifying (ohmic) contacts, Schottky diode, tunneling.

Unit III: Bipolar and Field Effect Transistors

Bipolar junction transistors: transistor action and dependence on device structure, current gain parameters, minority carrier distribution and terminal currents, Eber-Moll model

Metal-Oxide-Silicon System: MOS structure, capacitance, oxide and interface charge (charging of traps, tunneling through oxide), MOS Field-Effect Transistor: threshold voltage, derivation of current-voltage characteristics, dependence on device structure.

Small-geometry effects: mobility degradation due to channel and oxide fields, velocity saturation, ballistic transport, hot-electron effects, State-of-the-Art MOS Technology: Fin-FETs,

Unit IV: Microwave and Opto Electronic Devices

IMPATT: Static and Dynamic Characteristics, Small signal analysis, Transferred Electron Device, Negative differential resistivity, Transferred Electron Model, Modes of operation, Opto-Electronic Devices: P-N Junction Solar Cells, V-I Characteristics, Ideal Conversion efficiency, and spectral response.

Books Recommended:

1. Donald E. Neaman, Semiconductor Physics and Devices, Basic Principles, McGrawHill Publishing, 3rd Edition, 2003.

2. Ben G. Streetman, Solid State Electronic Devices, Prentice Hall of India Ltd, N. Delhi.
3. S. M. Sze, Physics of Semiconductor Devices, Wiley eastern Ltd.
4. Azeroff and Brophy, Electronic Processes in Semiconductors, McGraw Hill Publishing Company.
5. A. S. Grove, Physics and Technology of Semiconductor Devices, John Wiley and Sons, New York.

Semester - III

ELE19302C: Control System Engineering **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To learn basics of control systems and to understand the purpose of control systems.
- To analyze the stability of control systems.
- To acquaint the students with the understanding of modern control theory.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the various terms of basic and modern control system for the real time analysis and design of control systems.
- Analyse and apply the methods of stability of control systems.
- Perform time domain and frequency domain analysis.
- Perform state variables analysis for any real time system.

Detailed Syllabus:

Unit I: Control Systems, System Representation and Time Domain Analysis

Control Systems, types of control systems, feedback & its effects, linear & non-linear systems, superposition in linear systems, cascade and feed-forward control, Signal Flow Graph modeling of electrical and electronic systems, SISO and MIMO systems, Transfer function calculation using block diagram algebra and signal flow graph methods, Standard test signals, time response of first order and second control systems, Steady- state and transient response, Transient response specifications, S-plane root location & the transient response, Error analysis, Static and dynamic error coefficients, Controllers: Proportional, PI,PD and PID controllers.

Unit II: Stability and Frequency Analysis

State equations, advantages of state space techniques, State space representation of electrical networks, state transition matrix, state transition equations, Stability : Conditional an absolute stable systems, location of poles and stability, Routh-Hurwitz criterion, Root-locus plot , effect of addition of poles and zeros on root locus, Frequency domain analysis, advantages and disadvantages, Frequency domain specifications, Polar plot, Bode plot, gain margin and phase margin, Nyquist criterion.

Unit III: Laboratory Work

Time domain analysis of 1st and 2nd order system (Impulse and Step Response), Design of PI, PD and PID controllers, Root Locus Plot, Polar Plot, Study of Gain Margin and Phase Margin using MATLAB.

Books Recommended:

1. Modern Control Engineering by K-Ogata.
2. Feedback & Control Systems by Disteflno, Stubberud and Williams, McGraw HillInternational
3. Automatic Control systems by B. C. Kuo.
4. Linear Control System Analysis & Design by D. Azzo, Houfil.

Semester - III									
ELE19303C: Digital Signal Processing							**Course Category: CORE**		
Credits			**Total Credits**	**Maximum Marks**					**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**		
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**			
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**		**1 ¾ Hours**

Learning Objectives:

- To understand the need for digitization and its advantages.
- To develop a deep insight regarding convolution and correlation operations.
- To understand various transformation tools like DTFT and DFT.
- To understand the implementation of IIR & FIR digital filters.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the digital signal processing fundamentals, with practical applications in communication systems.
- Understand the intricacies of linear time-invariant system characteristics, enabling them to analyse and manipulate signals effectively.
- Explore the inter-relationship between discrete Fourier transform and various transforms, broadening their insight into signal processing techniques.
- Develop the ability to design digital filters tailored to specific specifications, showcasing practical skills in filter design.
- Gain insights into the significance of various filter structures.
- gain hands-on practical experience through the implementation of digital signal processing algorithms using MATLAB.

Detailed Syllabus:

Unit I: Discrete Time Signals and Systems

Review of Signals and Discrete Time Systems, A/D Conversion Process: Sampling, Frequency Relationships, Aliasing, Quantization, Encoding, Anti-Aliasing Filter. Classification of Discrete Time Signals, Manipulation of Discrete time signals. Systems, Introduction to LTI systems, Correlation: Cross- Correlation and Auto- Correlation, Properties of Auto-Correlation and Cross-correlation.

Unit II: Discrete Time Signal Transforms

Introduction to Fourier Series and Fourier Transform, Frequency Domain Sampling, DTFT, Introduction to DFT, Properties of DFT, Spectrum Analysis using DFT, Efficient Computation of DFT: FFT algorithms, Properties of WN, Radix- 2 FFT algorithms: Decimation in Time and Decimation in Frequency FFT algorithms, Z transform and its Properties

Unit III: Digital Filter Design

Frequency response for rational system functions, Basic structures for IIR systems: Design of IIR from continuous time filters, Frequency transformation of IIR low pass filters, Linear systems with generalized linear phase; Basic network structures for FIR filters; Design of FIR filters; window functions. Frequency sampling technique. Comparison of FIR and IIR filters,

Unit IV: Laboratory Work

Introduction to digital signal processing toolbox (MATLAB). Commonly used DSP based commands in MATLAB, Computation of Correlation and convolution of various sequences using MATLAB. DFT computation, Optimal order FIR filter design in MATLAB. Performance analysis of various windowing techniques for a given set of specifications using MATLAB.

Books Recommended:

1. Digital Signal Processing, A. V. Oppenheim and R. W. Shafer, Prentice Hall, 1985
2. Introduction to digital Signal Processing, J. G. Proakis and DG Manolakis, Prentice Hall
3. Introduction to Digital Signal Processing, Roman Kue, McGraw Hill Book Co.

Semester - III								
ELE19304C: Computer Networks							**Course Category: CORE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To learn computer networks and protocols.
- To analyze computer networks using simulation techniques.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the Network Fundamentals.
- Understand Network Design & Implementation.
- Understand Networking Devices & Technologies.
- Understand Network protocols & Standards.
- Understand Network Security and Performance Optimization.

Detailed Syllabus:

Unit I: Introduction to Computer Networks and Protocols

Introduction to computer networks, history and development of computer networks, network topologies, network architecture, network protocols and standards, network models, layered architecture, OSI model, TCP/IP model, guided and unguided media, errors in transmission, Encoding techniques, CSMA, CSMA/CD, CSMA/CA protocols. Error detection (Parity, CRC), Sliding Window, Stop and Wait protocols, switching (circuit and packet switching).

Unit II: Network Layer and Transport Layer

(IPv4 & IPv6), ARP, DHCP, ICMP, IGMP, Routing algorithms (unicast, multicast) Distance vector, Link state, Metrics, addressing techniques: address Classless (class A, class B, class C), CIDR, Subnetting and supernetting, Network Address Translation. Introduction to networking devices (Switches, Hub, Repeater, Router, Gateways etc.). Introduction to wireless LANs

Unit III: Transport & Application Layer

Transport and Application Layer Transport layer: Process to process delivery, user datagram protocol (UDP), transmission control protocol (TCP). Connection establishment and termination, flow and congestion control, timers, retransmission, TCP extensions, etc. Quality of services, Introduction to Network Security, overview of application layer-Electronic mail (SMTP, POP3, IMAP, and MIME), HTTP, Web services, DNS, SNMP

Unit III: Laboratory Work

The laboratory work shall be based on unit I through unit III and shall use hardware study as well as experiments using simulations.

Books Recommended:

1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 2006:
2. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, Fourth Edition, 2003:
3. Andrew S Tanenbaum, DJ Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010.
4. LL Peterson, BS Davie, Computer Networks: A Systems Approach, 5th Ed., Morgan-Kauffman, 2011.
5. W Stallings, Cryptography and Network Security, Principles and Practice, 5th Ed., Prentice- Hall, 2010

Semester - III								
ELE19305DCE: Microcontroller Architecture and Programming							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To develop knowledge of microcontrollers.
- To know the importance of different peripheral devices and their interfacing with microcontrollers.

Learning Outcomes

After studying the course, the students shall be able to:

- Distinguish between general-purpose microprocessors and microcontrollers.
- Describe the essential qualities that make microcontrollers a good fit for embedded systems.
- Understand the intel 8051 microcontroller, encompassing input/output pins, ports, external memory, counters, timers, serial data I/O, and interrupt handling.
- Program the microcontroller effectively in a variety of applications by mastering its addressing modes and instruction set.
- Connect different peripherals with 8051 microcontrollers and create circuits for memory interfacing.
- Learn about the PIC series microcontroller architecture, expanding their knowledge and skills in the field of microcontroller-based embedded systems.

Detailed Syllabus:

Unit I: Architecture and Instruction Set

Microcontroller versus General-purpose Microprocessors, Microcontrollers for embedded systems, Embedded applications, choosing a Microcontroller. Architecture of Atmel AT89C51Microcontroller, input/output pins, ports and circuits, external memory, counter and timer, serial data input and output, interrupt, Addressing Modes and Instruction Set.

Unit II: Serial Communication and Interrupts Programming

Timer / Counter programming: programming 8051 timers, counter programming, pulse frequency and pulse width measurements. Serial communication programming: Basics of serial communication, 8051 connection to RS232, 8051 serial communication programming. Interrupts programming: Interrupts of 8051; programming timer interrupts, programming external hardware interrupts, and programming serial communication interrupts.

Unit III: Interfacing and PIC Microcontrollers

Programmable peripheral interface (PPI)-8255, programming 8255, 8255 interfacing with 8051. Interfacing Key board. Interfacing LED/ LCD, Interfacing A/D & D/A converters, Interfacing stepper motor. Introduction to PIC series of Microcontrollers. Architecture and programming of 8-bit and 16-bit PIC microcontrollers.

Unit IV: Laboratory Work

The Laboratory work shall include 10 Practicals based on units I through IV consisting of Assembly Language Programming and interfacing using Assemblers, simulators and trainers.

Books Recommended:

1. Muhammad Ali Mazidi, J. Gillispie Mazidi,The 8051 Microcontroller & Embedded Systems, Prentice Hall 2000.
2. Kenneth J. Ayala., "The 8051 Microcontroller Architecture Programming and Applications", Penram International Publishing (India). 1996.
3. Myke Predko, Programming and Customizing the PIC Microcontroller.
4. Fernando E. Valdes-Perez, Ramon Pallas-Areny, Microcontrollers: Fundamentals and Applications with PI.

Semester - III

ELE19306DCE: CMOS VLSI and Nano-Electronics –III (Analog and Mixed IC Design) — **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To acquaint students with the importance and applications of analog and mixed design.
- To make students learn about the fundamentals of analog and mixed CMOS design.
- To acquaint students with the analysis and design of CMOS amplifiers, oscillators, multipliers, switched

capacitor circuits, etc.

- To acquaint students with the issues related to the fabrication of analog and mixed ICs.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the significance of different biasing styles and apply them aptly for different circuits.
- Design all basic building blocks like sources, sinks, mirrors, up to layout level.
- Comprehend the stability issues of the systems and should be able to design OpAmp fully.
- Identify the suitable different topologies of the constituent sub systems and corresponding circuits as per the specifications of the system.
- Design Analog integrated system completely upto tape-out including parasitic effects.
- Use the techniques and skills for design and analysis of CMOS based switched capacitor circuits.
- Understand the necessity of mixed signal systems and demonstrate corresponding layout.
- Identify, formulates, and solves engineering problems in the area of mixed-signal design.
- Understand the different architectures of data converters.
- Design data converters for mixed signal environment.

Detailed Syllabus:

Unit I: Analog CMOS Sub-circuits

MOS Switch; MOS Diode/Active Resistor; Current Sinks and Sources, Translinear Circuits: Ideal Translinear Element, Translinear-loop-circuit synthesis, Various Translinear circuits, Squarer/divider, Squarer rooting, Current Mirrors, The Basic Current Mirror, Cascoding the Current Mirror, Biasing Circuits Amplifiers, Gate-Drain Connected Loads, Current Source Loads, Common-Source Amplifier, The Cascode Amplifier, The Common-Gate Amplifier, The Source Follower (Common-Drain Amplifier), The Push-Pull Amplifier, Differential Amplifiers.

Unit II: References, Multistage Amplifiers and Nonlinear Circuits

Voltage and Current References, MOSFET-Resistor Voltage References, Parasitic Diode-Based References, Bandgap Reference Design, Operational Amplifiers, The Two-Stage Op-Amp, The Operational Transconductance Amplifier (OTA), Basic CMOS Comparator Design, MOS Analog Multipliers: Multiplier Design Using Squaring Circuits, The Multiplying Quad, Simulating the Operation of the Multiplier; Mixing, Modulation and Frequency Translation: Single-Device Mixers, Modulation and Demodulation using Analog Multipliers

Unit III: Data Converters

Analog Versus Discrete Time Signals; Converting Analog Signals to Digital Signals; Sample-and-Hold (S/H) Characteristics; Digital-to-Analog Converter (DAC) and Analog-to-Digital Converter (ADC) Specifications; DAC Architectures: R-2R Ladder Network DAC, Cyclic DAC; Pipeline DAC; ADC Architectures: Flash ADC; Two-Step Flash ADC, Pipeline ADC, Integrating ADC, The Successive Approximation ADC; Oversampled converters; First-Order ΣΔ Modulator; Higher Order ΣΔ Modulators.

Unit IV: Laboratory Work

The laboratory work shall include minimum 10 practicals on Digital design including combinational (Static and Dynamic) and sequential circuits, Memory and Programmable logic devices

Books Recommended:

1. P. R. Gray, P. J. Hurst, S. H. Lewis and R. J. Meyer, Analysis and Design of analog integrated circuits, John Wiley and Sons, 2001.
2. R. Jacob Baker, CMOS, Circuit Design, Layout, and Simulation, JOHN WILEY & SONS, 2010.

Semester - III

ELE19307DCE: Digital System Design using HDL — **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To get acquainted with the knowledge of hardware description languages and VHDL.
- To design combinational and sequential circuits using VHDL
- To develop and test various digital systems using VHDL.

Learning Outcomes

After studying the course, the students shall be able to:

- Emerge with a comprehensive understanding of the IEEE Standard Hardware Description Language (VHDL).
- Understand the model complex digital systems at several level of abstractions: behavioural and structural, as well as synthesis.
- Develop the proficiency to create and simulate register-level models for digital systems.
- Design and model complex digital systems, and test various digital systems using VHDL

Detailed Syllabus:

Unit I: Hardware Description Languages and VHDL

Hardware Description Languages: Introduction to VHDL, Design flow, Code structure: Library declarations, Entity and Architecture, Introduction to behavioural, dataflow and structural modeling. Data types: BIT, Standard logic, Boolean, Integer, real, Signed and Unsigned Data types, Arrays, Bit vector and Standard logic vectors, Operators and attributes: Assignment, Logical, Arithmetic, Relational and concatenation operators.

Unit II: Concurrent, Sequential Codes and State Machines

Concurrency, Concurrent verses Sequential codes, advantages of concurrent codes, concurrent and sequential statements: WHEN (simple and selected), GENERATE, PROCESS, IF, ELSIF, WAIT, CASE,LOOP, Signal versus Variable, Bad Clocking, Brief concepts of Finite State Machines,(Melay and Moore Machines), state diagrams and state tables.

Unit III: Combinational and Sequential Circuit Design

Elements combinational and sequential circuits, VHDL modeling combinational systems: Gates, Binary adders and Subtractors, Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, Boolean functions using Multiplexer. Shannon's expansion theorem, VHDL Modelling of Sequential Circuits: Flip-Flops, Shift Registers, Counters UPDOWN, Johnson and Ring Counters, Familiarity with Quartus Altera/ Xilinx ISE Suite. Combinational systems Implementation: Adder, Subtractor MUX, DEMUX, Encoder, Decoder and Comparator etc. Sequential system Implementation: Flip Flop, Shift registers, ALU and LFSR.

Unit IV: Laboratory Work

Familiarity with Quartus Altera/ Xilinx ISE Suite. Combinational systems Implementation: Adder, Subtractor MUX, DEMUX, Encoder, Decoder and Comparator etc. Sequential system Implementation: Flip Flop, Shift registers, ALU, LFSR.

Books Recommended:

1. Pedroni V. A., Circuit Design with VHDL, PHI, 2008.
2. J.Bhasker, VHDL Primer, Pearson Education, India.
3. Wakerly J. F., Digital Design – Principles and Practices, Pearson Education,2008.
4. Brown S. and Vranesic Z., Fundamentals of Digital Logic with VHDL Design, TMH 2008.

Semester - III								
ELE19308DCE: Speech and Audio Processing							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To learn the fundamentals of speech
- To get knowledge of speech processing applications.

Learning Outcomes

After studying the course, the students shall be able to:

- Comprehend the intricate processes involved in speech production and perception.
- Analyse speech signals in both the time and frequency domains.
- Design and implement algorithms tailored for the processing of speech signals, showcasing their ability to navigate the complexities of this specialized field.
- Develop the skills necessary to construct basic speech recognition systems, demonstrating their proficiency in applying theoretical concepts to practical applications in the realm of speech processing.
- Simulate and recognize speech signals using MATLAB.
- Devise various algorithms in the frequency domain using MATLAB.

Detailed Syllabus:

Unit I: Fundamentals of Speech and Prediction

The human speech production mechanism, LTI model for speech production, nature of the speech signal, linear time varying model, types of speech, voiced and unvoiced decision making, Lattice structure realization, forward linear prediction, auto correlation covariance method, uniform and non-uniform quantization of speech,waveform coding of speech,the .726 standarad for ADPCM.

Unit II: Speech Synthesis

History of text- to- speech system, synthesizer technologies, HMM based speech synthesis, sine wave synthesis, speech transformation, emotion recognition from speech, watermarking for authentication of a speech/ Music signal, digital watermarking, watermarking in capestral domain.

Unit III: Speech Processing Applications

Speech Recognition systems, Architecture of a Large Vocabulary Continuous Speech Recognition System, Deterministic Sequence Recognition for ASR, Statistical Sequence Recognition for ASR, VQHMM based speech recognition. Speech Enhancement, Adaptive Echo Cancellation.

Unit IV: Laboratory Work

To simulate speech processing model using Matlab, Speech recognition systems implementation Acoustic analysis, linear time warping, dynamic time warping (DTW), Statistical Sequence Recognition for ASR: Bayes rule, Hidden Morkov Model (HMM), VQ- HMM based speech recognition. Speech watermarking using Discrete cosine Transform (DCT), Discrete Wavelet Transform.

Books Recommended:

1. Speech and Audio Processing, Dr. Shaila D. Apte, Wiley Publications
2. Digital Signal Processing, Dr. Shaila D. Apte, Wiley Publications
3. Theory and Applications of Signal Processing, L. R. Rabiner and B. Gold, Prentice Hall 1985
4. Digital Signal Processing, A. V. Oppenheim and R. W. Shafer, Prentice Hall, 1985
5. Introduction to Digital Signal Processing, J. G. Proakis and DG Manolakis, Prentice Hall

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Semester - III

ELE19309DCE: Advanced Communication Systems **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To provide an understanding of the basic concepts, operation, and applications of modern radar system.
- To acquire knowledge of multiple access techniques.
- To understand various switching techniques.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire a deep understanding of modern radar systems, covering fundamental concepts such as bandwidth considerations, pulse repetition frequency (PRF), radar cross-section, and clutter.

- Gain knowledge of telecommunication switching techniques, including time division switching, space switching, and hybrid switching, and traffic engineering principles.
- Develop expertise in multiple access techniques such as FDMA, TDMA, and CDMA.
- Understand the application of these techniques in Very Small Aperture Terminals (VSAT).
- Gain practical experience by developing a simple switching model using MATLAB.
- Apply theoretical knowledge in the laboratory by verifying the radar equation using MATLAB.

Detailed Syllabus:

Unit I: Modern Radar System and Satellites

Fundamentals of Surveillance Radar and Design: Bandwidth considerations, PRF, Un-ambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter, Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations.

Unit II: Telecommunication Switching Techniques

Time division switching: Time switching, space switching, Three stage combination switching, n-stage combination switching; Traffic engineering: Hybrid switching, Two/Four wire transmission, Erlang formula and signalling.

Unit III: Multiple Access Techniques

Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT.

Unit IV: Laboratory Work:

To develop a simple switching model using Matlab, to study various multiplexing techniques used telecommunication networking, to study stored program based space division switch, to under fading in satellite communication using wireless communication link, to verify radar equation in Matlab.

Books Recommended:

1. J.G. Proakis, "Digital Communication", MGH 4TH edition.
2. Edward. A. Lee and David. G. Messerschmitt, "Digital Communication", Allied Publishers (second edition).
3. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, "Digital Communication Techniques", PHI.

Semester - III

ELE19310DCE: RF Engineering — **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand and gain complete knowledge about RF basic concepts and RF system design.
- To understand the requirements of modern RF systems.

Learning Outcomes

After studying the course, the students shall be able to:

- Develop a thorough understanding of RF basic concepts, including the analysis of high-frequency passive components, transmission lines, and circuit configurations.
- Acquire the skills to design RF circuits, including oscillators, mixers, and filters. Explore the design of resonant oscillators and various filter configurations.
- Understand the integrated circuit requirements for modern RF and wireless systems.
- Develop expertise in RF system design, covering link design, fading considerations, and the design of protected and non-protected microwave systems.
- Apply theoretical knowledge through practical hands-on training using network optimization tools. Gain practical insights into antenna system tilting and receiver design for FM broadcast, digital cellular, and multi-meter wave point-to-point systems.

Detailed Syllabus:

Unit I: RF Passive Components and Transmission Line Analysis

High frequency Resistors, Capacitors and Inductors – Transmission Line Analysis line equation – Microstripe line – SWR voltage reflection co-efficient propagation constant, phase constant, phase velocity –smith chart – parallel RL and RC circuits ABCD parameters and S parameters.

Unit II: RF Circuits Design

RF Oscillator Design, Fixed frequency oscillator – Dielectric resonant oscillator, Voltage controlled oscillator- sun element oscillator – RF mixer design – single ended mixer – double ended mixer – RF filter resonator and filter configuration – Butterworth and chebyshev filters – Design of micro stripe filters.

Unit III: Communication Circuits

Integrated Circuit Requirements for Modern RF/Wireless System; RF Circuits – Low-Noise Amplifier (LNA) and Power Amplifier (PA); Oscillators; Mixers; Modulators and Demodulators; Integration Issues of RF and Baseband Circuits

Unit IV: RF System Design and Lab Work

Link design – Fading design – Protected and non-protected microwave systems – Path calculation Spread spectrum microwave system – Compatibility – Safety co-ordinate systems – Datam‟s & GPS Receiver design receiver architecture dynamic range – frequency conversion and filtering examples of practical receivers FM broadcast, Digital cellular, Multimeter wave point to point,Direct conversion GSM receiver-RF MEMS: Concept, Implementation and Applications, Hands on training using Network optimization and planning tool. Field visit at any Cell site, Study of various physical and logical channels in GSM system. Study of tilting of antenna system in GSM.

Books Recommended:

1. Reinhold Ludwig and PavelBretchko, "RF circuit design," Pearson Education, 2007.
2. David Pozar, "Microwave and RF design of Wireless systems," Johnwiley, 2008.
3. Josn Rogers and Calvin Plett, "Radio frequency Integrated circuit design," Artech house, 2002.
4. FerriLosee, "RF systems, Components and Circuits handbook," Artech house, 2002.
5. Joseph.J.Carr, "Secrets of RF circuit design," Tata McGraw Hill, 2004.
6. VivekVaradhan," RF MEMS and their applications", Wiley Eastern edition, 2003.

Semester - III

ELE19311DCE: Soft Computing and Neural Networks **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand the fundamental theory and concepts of neural networks and its applications.
- To understand the concepts of fuzzy sets, fuzzy logic control and other machine intelligence applications of fuzzy logic.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the fundamental theory and concepts of neural networks and its applications.
- Acquire the concepts of fuzzy sets, fuzzy logic control and other machine intelligence applications of fuzzy logic.
- Develop intelligent systems leveraging the paradigm of soft computing techniques.
- Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.

Detailed Syllabus:

Unit I: Overview of Crisp Sets, Fuzzy Sets and Relations

Basic Concepts of Crisp Sets and Fuzzy Sets, Basic Types of Fuzzy Sets, Sets, Representation of Fuzzy Sets, Fuzzy Relations, Operation on Fuzzy relations, Composition of Relations, Extension Principle for Fuzzy Sets, Concept and models of Fuzzy logic Circuits-viz. AND, OR and NOT.

Unit II: Fuzzy Logic and Rule based Systems

Overview of classical logic, Multi-valued logic, Fuzzy sets and probability theory, Probability vs. possibilities, Approximate reasoning, Fuzzy rule based Systems: Structure of Fuzzy rules, decomposition of compound rules, aggregation of fuzzy rules, Graphical techniques of inferences, Types of fuzzy rule based models.

Unit III: Introduction to Neural Networks

Biological and Artificial Neurones, Neuron Models: Classification and Linear Separability, X-OR Problem, Hopfield Networks, Overview of Neural Networks Architectures: Multi-layered Feed forward and Recurrent Networks, Learning: Supervised, Unsupervised and Reinforcement, Learning Laws. Backpropagation (BP) Networks, Generalized delta rule, BP Training Algorithm and Derivation for Adaptation of Weights.

Unit IV: Programming

Implement fuzzy set operation and properties; verify various laws associated with fuzzy set; Demonstration of Mamdani and TSK rule based system using fuzzy logic tool box; Implement basic logic functions using Adaline and Madaline with bipolar inputs and outputs; implement composition of fuzzy and crisp relations; Implement discrete Hopfield network and test for input pattern; implement back propagation network for a given input pattern;

Books Recommended:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, G. Klirabd B. Yuan, Printice Hall of India
2. Neural Networks and Fuzzy systems,: A Dynamical System Approach to Machine Intelligence, Printice Hall of India
3. Neura;l Networks in Computer Intellligence, Limin Fu, Mcgraw Hill International
4. Adaptive Recognition and Neural Networks, Yoh-Han Pao, Addison Weseley
5. Introduction to the Theory of Neural Computations, John Hertz, Anders Krogh, Addison Wesley.

Semester - III

ELE19312DCE: Cryptography and Information Security — **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To learn the fundamentals of information security
- To enable the students to identify computer and network security threats.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the Cryptographic Principles.
- Acquire the knowledge of Cryptographic Algorithms.
- Acquire the knowledge of Public Key Infrastructure.
- Acquire the knowledge of Information Hiding and Watermarking.
- Perform the practical implementation of Cryptographic Algorithms.

Detailed Syllabus:

Unit I: Fundamentals of Information Security

Need for information security, Active and passive attacks, Introduction to Cryptography, Transposition and substitution ciphers, One time pad, Stream and Block ciphers, additive and multiplicative ciphers, Data scrambling and descrambling Cryptanalysis of classical ciphers. Introduction to modular arithmetic. Differential and linear cryptanalysis.

Unit II: Cryptographic Algorithms

Introduction to Data encryption standard, Security of DES, Advanced Encryption standard (AES), Private and public keys. Need of Pseudorandom Code Generators in Cryptographic algorithms. PN sequence generator, Geffe generator, Stop and Go generator.

Unit III: Information Hiding for covert communications

Need of information hiding, Hiding versus Encryption, Requirements of a Data Hiding System, Hiding Capacity, Robustness and Imperceptibility, Steganography and watermarking. Hiding in Spatial and Frequency domains. Advantages and disadvantages of spatial and frequency domain embedding. LSB based embedding algorithm for data hiding.

Unit IV: Laboratory Work

The laboratory work shall be based on unit I through unit III and shall use hardware study as well as experiments using simulations (at least 10 Practicals to be conducted).

Books Recommended:

1. W. Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey, 1999.
2. B. Schneier , "Applied Cryptography", John Willey & Sons, Inc., 2nd edition, 1996.
3. Lu, S.: Multimedia security: Stenography and digital watermarking techniques for protection of intellectual property, Idea Group Publishing, USA. (2005).

Semester - III

ELE19313DCE: Advanced Microprocessors **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To understand basic architecture of 16 bit and 32-bit microprocessors.
- To understand interfacing of 16-bit microprocessor with memory and peripheral chips involving system design.
- To understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessors.
- To understand RISC and CISC based microprocessors.
- To understand concept of multi core processors.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire a comprehensive understanding of advanced processor architectures, including the 80286, 80386, and 80486.
- Gain proficiency in interfacing 16-bit microprocessors with memory and peripheral chips for effective system design.
- Grasp techniques to enhance instruction execution speed, thereby improving overall microprocessor performance.
- Explore the concept of multi-core processors and demonstrate a clear understanding of the necessity and applications of coprocessors and digital signal processors in contemporary computing systems.

Detailed Syllabus:

Unit I: Intel 8086, 80186 and 80286 Processors

Architecture and working of 8086 and 80186 Microprocessor, Register set of 8086 and 80186 Microprocessor, Addressing Modes and memory segmentation in 8086 and 80186 microprocessor, Differences between 8086 and 80186 microprocessors. Intel 80286 Microprocessor, 80286 Architecture, system connection – Real and Protected mode operations.

Unit II: Advanced Intel Processors

Intel 80386 Microprocessor, 80386 Architecture and system connection – Real operating mode – 386 protected mode operation – segmentation and virtual memory – segment privilege levels and protection, 80486 – Processor model – Reduced Instruction cycle – five stage instruction pipe line – Integrated coprocessor – On board cache – Burst Bus mode, Recent trends in microprocessor design. Pentium –super scalar architecture.

Unit III: Advanced and Special Purpose Processors

Architecture, addressing and programming of Digital Signal Processors, co-processors and I/O processors.

Difference between CISC and RISC processors, various emerging trends in Microprocessor Design. Introduction to graphics and other special purpose processors, Introduction to architecture of multi-core processors.

Unit IV: Laboratory Work

The Laboratory work shall be based on units I through IV. The laboratory work shall include al least 10 practicals on the study of instruction sets of Intel Processors, Programming exercises for 16, 32 and 64 bit data processing, Use of Macros and Procedures, IVT and ISR, DSP programming for Image Processing such as Image Compression, Image Restoration, Image Enhancement, etc.

Books Recommended:

1. Introduction to 8086, 80186,80286, 80386, 80486, Pentium and Pentium Pro Processors, B. Bray, TMG
2. Advanced Microprocessors by Daniel Tabak McGraw-Hill.
3. Advanced Microprocessors by A. P. Godse, D. A. Godse Technical Publications.
4. Advanced Microprocessors and Peripherals by K. M. Burchandi, A. K. Ray Tata McGraw Hill Education
5. Advanced Microprocessors by Y. Rajasree, New Age International.

Semester - III

ELE19009GE: Embedded Systems — **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To get familiar with basics of embedded systems.
- To develop various embedded system modules using microcontrollers.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire basic knowledge about embedded systems, encompassing fundamental concepts and principles.
- Understand the significance of microcontrollers within embedded systems and identify their diverse applications in real-world scenarios, with a specific focus on exploring practical examples.
- Develop proficiency in recognizing and utilizing a range of tools essential for applications in the field of embedded systems. These tools include programming environments, simulation tools, debugging tools, and hardware components.

Detailed Syllabus:

Unit I: Introduction to Embedded Systems

Definition of Embedded Systems, Embedded Systems vs General Computing Systems, History of Embedded Systems, Embedded System Models, application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems.

Unit II: Typical Embedded Systems

Core of embedded systems, General Purpose and domain specific processors, Memory of embedded systems, embedded system life cycle, types of embedded operating systems, process management (concept, scheduling and scheduling algorithms).

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. Introduction to Embedded Systems, A Cyber Physical approach, Edward A. Lee and Senjit Seshia.
2. Embedded Systems Design: An Introduction to Processes, Tools and Techniques by Arnold S. Berger, CMP.
3. Real Time System Design and Analysis by Philips A. Laplante.
4. Real Time Concepts for Embedded Systems, Qing Li, Elsevier, 2011.

Semester - III

ELE19010GE: Modern Communication Systems **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To acquire knowledge about principles and techniques of modern communication systems and techniques.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Acquire a comprehensive understanding of modern radar systems, covering surveillance radar fundamentals, bandwidth considerations, and the design of tracking and search radars.
- ➢ Develop expertise in satellite communication, including basic transmission theory, system noise considerations, and the design of downlinks.
- ➢ Understand hybrid switching, two/four-wire transmission, and signalling techniques, laying the foundation for effective communication network design.
- ➢ Understand multiple access techniques essential for communication systems, including Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), and Code Division Multiple Access (CDMA).
- ➢ Apply acquired knowledge to practical scenarios in radar systems, satellite communication, and telecommunication switching.

Detailed Syllabus:

Unit I: Modern Radar AND Satellite Communication

Fundamentals of Surveillance Radar and Design: Bandwidth considerations, Tracking Radar Tracking and Search Radars, Radar Guidance, Importance of Mono Pulse Radar, Satellite Communication Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Down Links, Domestic Satellite Systems Using Small Earth Stations.

Unit II: Telecommunication Switching Techniques

Time division switching: Time switching, space switching and Traffic engineering: Hybrid switching, Two/Four wire transmission, Erlang formula and signaling Multiple Access Techniques Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access.

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. J.G. Proakis, "Digital Communication", MGH 4TH edition.
2. Edward. A. Lee and David. G. Messerschmitt, "Digital Communication", Allied Publishers (second edition).
3. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, "Digital Communication Techniques", PHI.

Semester - III

ELE19011GE: Fundamentals of Fuzzy Logic **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	0	2	10	40	0	50	1 ¼ Hours

Learning Objectives:

- To get an overview of fuzzy sets and relations.
- To understand fuzzy logic and rule-based systems.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Have an understanding about the classical and fuzzy logic and their various concepts and applications.

- Have an overview of fuzzy sets, relations and their operations.
- Design and develop a fuzzy rule-based systems.

Detailed Syllabus:

Unit I: Overview of Crisp Sets, Fuzzy Sets and Relations

Basic Concepts of Crisp Sets and Fuzzy Sets, Basic Types of Fuzzy Sets, Sets, Representation of Fuzzy Sets, Fuzzy Relations, Operation on Fuzzy relations, Composition of Relations.

Unit II: Fuzzy Logic and Rule based Systems

Overview of classical logic, Multi-valued logic, Fuzzy sets and probability theory, reasoning, Fuzzy rule based Systems: Structure of Fuzzy rules, decomposition and aggregation of compound rules. Composition of fuzzy and crisp relations.

Books Recommended:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, G. Klirabd B. Yuan, Prentice Hall of India
2. Neural Networks and Fuzzy systems,: A Dynamical System Approach to Machine Intelligence, PHI
3. Timothy J. Ross "Fuzzy Logic with Engineering Applications,"Mcgraw Hill,1995
4. Fakhreddine O Karray and Clarance De Silva, "Soft Computing and Intelligent Systems Design, Theory,Tools and Applications", Pearson Education, India,2009

Semester - III

ELE19012GE: Fundamentals of Information Security **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To learn the fundamentals of information security.
- To be able to identify computer and network security threats.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the basics of Information Security.
- Understand the Security Threats and Attacks.
- Understand the Cryptography Fundamentals.
- Understand the Cryptographic Algorithms.
- Acquire the knowledge of Information Hiding and Watermarking.

Detailed Syllabus:

Unit I: Information security

Need for information security, Active and passive attacks, Introduction to Cryptography, Transposition and substitution ciphers, One time pad, Stream and Block ciphers, Cryptanalysis. Data scrambling and descrambling Cryptanalysis of classical ciphers. Introduction to modular arithmetic. Differential and linear cryptanalysis.

Unit II: Cryptographic Algorithms and Information Hiding

Introduction to Data encryption standard, Security of DES, Advanced Encryption standard (AES), Private and public keys. Need of Pseudorandom Code Generators in Cryptographic algorithms. PN sequence generator, Information Hiding, Need of information hiding, Requirements of a Data Hiding System, Hiding Capacity, Robustness and Imperceptibility, Steganography and watermarking.

To perform at least 10 experiments using hardware/software on theory part of the syllabus.

Books Recommended:

1. Cryptography & Network Security, Forouzan, Mukhopadhyay, McGrawHill
2. Cryptography and Network Security (2nd Ed.), AtulKahate, TMH
3. Information Systems Security, Godbole, Wiley-India
4. Information Security Principles and Practice, Deven Shah, Wiley-India 5. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", 2nd Edition, Cengage Learning Pub

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Semester - III

ELE19005OE: Computing and Informatics -III **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To get familiar with C-programming language
- To enable students to solve basic mathematical problems using C- Programming.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire the basic understanding of C language primitives.
- Acquire the knowledge of Algorithms & Flowcharts.
- Acquire the knowledge of Syntax and Semantics.
- Understand the loops and programming Structs.
- Perform the practical implementation of Algorithms.

Detailed Syllabus:

Unit I: Introduction

Introduction to algorithms and flow charts, Introduction to programming, types and categories of programming languages. Introduction to C programming language, declarations, data types, expressions, control statements, loops arrays, and functions.

Unit II: Lab Work

Writing C programs using basic programming elements including control statements, arrays, function

Books Recommended:

1. Yashwant Kanitker "Let Us C" 13th Edition BPB Publication.
2. Michael E. Whitman "Principles of Information Security" 4th Edition, Cengage Learning India.
3. S. K. Srivastava "C in Depth" BPB Publications.

Semester - III

ELE19006OE: Electronic Devices & Circuits-III **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To understand the basics of semiconductors and diodes.
- To characterize various semiconductor diode types.

Learning Outcomes

After studying the course, the students shall be able to:

- To study basics of semiconductor & devices and their applications in different areas.

- Comprehend the operation, types and applications of diodes.
- Know the characteristics of diodes and transistors
- Use diodes for different applications.
- Convert ac signals into dc signals.

Detailed Syllabus:

Unit I: Semiconductors

Conductors, insulators, Semiconductors, Semi-conductor: Intrinsic & Extrinsic Semiconductors. Temperature co-efficient. Definition of P and N types of semiconductor, PN Junction, Junction-Barrier potential.

Unit II: Diodes

Diode, Rectifiers: Half wave-Full wave bridge. Zener Diode, Light Emitting Diode (LED), Photodiode.

Lab Work:

- Finding the I-V characteristics of diode.
- Designing Half wave and full wave rectifiers.
- Testing of Zener Diode.
- Testing of LED.
- Testing of Photodiode.

Books Recommended:

1. Boylestead, Electronic Devices and Circuit Theory.
2. Sidra and Smith, Microelectronic Circuits.

Semester - IV

ELE19401C: Communication Engineering - II **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To learn the basic concepts of information theory and coding.
- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand spread spectrum modulation techniques.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire a solid understanding of information theory, including measures of information, block to variable length coding, Markov models, entropy, and channel capacity.
- Gain proficiency in source encoding, coding efficiency, and classic coding techniques such as Shannon-Fano and Huffman coding.
- Master digital modulation techniques, including the generation and detection of ASK, FSK, PSK, and Differential PSK.
- Understand baseband receiver concepts, optimum filters, correlators, and the probability of error in each modulation scheme.
- Understand the theory of spread spectrum digital communication systems.
- Apply error control coding principles, including linear block codes and cyclic codes.
- Gain practical experience in matrix representation of linear block codes and understand the polynomial representation of cyclic codes through examples.
- Gain practical skills through at least 10 hands-on laboratory sessions covering all units, utilizing MATLAB and hardware.
- Apply theoretical knowledge to real-world scenarios, performing practical experiments related to information theory, digital modulation, and spread spectrum techniques.

Detailed Syllabus:

Unit I: Information Theory

Introduction to Information Theory, Measure of information, Information content of Messages, Information Inequalities; Block to variable length coding-I: Kraft's inequality. Information sources, Markoff Model for Information sources, Information Content of a Discreate Memoryless Channel, Entropy and Information rate of Markoff sources, Joint Entropy and Conditional Entropy, Channel Capacity, Shannon's Theorem, Shannon- Hartley Theorem, Bandwidth S/N Trade–off, Source Encoding, Coding Efficiency, Shannon- Fano Coding, Huffman Coding..

Unit II: Band Pass Digital Carrier Modulation and Channel Coding

Digital modulation techniques: Generation and Detection of Amplitude Shift Keying (ASK), frequency Shift keying (FSK), Phase Shift Keying, and Differential Phase Shift Keying (PSK and DPSK), base band receiver Optimum Filter, Co-relator, Probability of Error in each Scheme,. Error Control Coding: Linear Block codes, (7, 4) Linear Block Coding, matrix representation of linear block codes, Cyclic Codes, polynomial representation (examples).

Unit III: Wide Band Digital Communications and Laboratory Work

Basics of Wide band Systems, Generation of Spreading Codes (PN Codes, Gold Codes), Properties of PN codes, Theory of Spread Spectrum Modulation, Model of Spread Spectrum Digital Communication System, Direct-Sequence Spread Spectrum (DSSS): Processing Gain, Performance and Generation and Detection, Frequency Hopping Spread-Spectrum (FHSS): Generation and Detection, Types, Introduction to OFDM, FBMC, F-OFDM and UBMC, Performing at least 10 Practical's across all the units using Matlab and Hardware.

Books Recommended:

1. Digital Communication By Simon Hykin.
2. Digital and Analog Communication by K. Shan Mugam.
3. Digital and Analog Communication by Tomasi.
4. Digital Communications By Bernard Sklar, Pearsons Education.
5. Digital Communications By John G. Proakis McGraw- Hill International Editions.
6. Information Theory Coding and Cryptography by Ranjan Bose, TMH.

Semester - IV

ELE19402C: Electronic Instrumentation **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
2	0	1	3	15	40	20	75	1 ¼ Hours

Learning Objectives:

- To introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements.

Learning Outcomes

After studying the course, the students shall be able to:

- To identify various errors in measurement system and correct them.
- To know the fundamentals of measuring systems including the particular limitations and capabilities of a number of measuring devices (pressure transducers, strain gages, thermocouples, etc.) and Equipment's (oscilloscope, spectrum analyzer, etc.).
- To be familiar with various computer-controlled test systems

Detailed Syllabus:

Unit I: Measurements and Instrumentation

Fundamentals of Measurements Errors in measurement; Controlling and Networking of Instruments; Signals and Signal Conditioning; Noise and Interference Transducers: Classification of transducers, characteristics and choice of transducers; Resistance, Capacitance, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Techogenerators, Measurement of displacement, velocity, acceleration, force, torque, strain, speed, and sound, temperature, pressure, flow, humidity, thickness, pH, position. Counters, Digital frequency meters and time meters, Universal counter timer. Digital Voltmeter: General Characteristics, Ramp type DVM, Staircase ramp DVM, Successive approximation type DVM, Integrating type DVM Dual slope A/D DVM, Digital ohm meter, Digital capacitance meter, Digital modulation index meter, Digital quality factor meter, Digital tan delta meter, Digital IC tester.

Unit II: Oscilloscopes, Analyzers and Analytical Instruments

Dual trace Oscilloscope, Dual beam Oscilloscope, Sampling Oscilloscope, Analog and Digital Storage Oscilloscope, Harmonic distortion analyzer, Wave analyzer, Frequency selective and Heterodyne wave analyzer, Spectrum Analyzer, Spectrum Analyzer characteristics, Bio-medical Instruments- ECG, Blood Pressure measurements, Spectrophotometers, Electron Microscope, X-ray diffractometer, Instrumentation Amplifiers and Radio Telemetry.

Unit III: Laboratory Work

The laboratory work shall include minimum 10 practicals on transducers, digital measurements and signal analyzers.

Books Recommended:

1. NihalKularatna, Digital and Analogue Instrumentation testing and measurement, IEE, 2003
2. J. G. Webster, Measurement, Instrumentation and Sensors Handbook, CRC Press, 1999.
3. T. S. Rathore, Digital Measurement Techniques, Narosa Publishing House, New Delhi.

Semester - IV

ELE19403C: Industrial Training and Seminar Work **Course Category: CORE**

Credits	Total Credits	Maximum Marks			Time Allowed for Theory
		Internal	End Term	Total	

Lecture	Tutorial	Practical			Theory	Lab		Examination
0	0	4	4	50	0	50	100	½ Hours

Learning Objectives:

- To expose the students to actual working environment and enhance their knowledge and skill from what they have learnt theoretically.
- To develop presentation, discussion and listening skills.

Learning Outcomes

After studying the course, the students shall be able to:

- Get additional exposure in the new and emerging areas in the field of Electronics.
- Explore the possible areas of Jobs.
- Acquire knowledge about the electronic systems used in everyday life.
- Make contacts with industry people for the future progress.
- Achieve the skill of presenting the works and ideas.

Detailed Syllabus:

Unit I: Seminar Work (1 Credit)

Each student shall be required to deliver a power point presentation on any topic pertaining to some latest area in the field of Electronics & Communication. Each student shall be evaluated for his/her Seminar Work by a team of faculty members headed by the Seminar Incharge.

Unit II & III: Industrial Training (2 Credits)

The students are required to undergo training at some centre of excellence, outside the State, to get additional exposure in the new and emerging areas in the field of Electronics. Training Incharge/s from the Department shall accompany the students for making necessary academic and other arrangements at the host institute. At the end of the training programme, the performance of the students shall be evaluated by the host institute in collaboration with the Training Incharge.

Semester - IV

ELE19404C: Project Work **Course Category: CORE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
0	0	5	5	25	0	100	125	1 ¼ Hours

Learning Objectives:

- To provide students with the opportunity to synthesize knowledge from various areas of learning, and critically and creatively apply it to real life situations.
- To acquire the skills to communicate effectively and to present ideas clearly.

Learning Outcomes

After studying the course, the students shall be able to:

- Design and develop prototype solutions for real life problems.
- Acquire the skills to communicate effectively and to present ideas clearly.
- work in teams suitable for industrial prospects.
- Troubleshoot the problems associated with the daily life appliances.

Detailed Syllabus:

The students shall be divided into groups, with not more than 4 students in a group. Each group of students shall choose to work on a hardware/software project pertaining to the area of Electronics. The major theme of the project shall be to develop a prototype solution for a commercially needful application. Each Project Group shall work under the supervision of Project Guide allocated within/outside the Department. The project Reports prepared by the students, as well as the working prototype shall be evaluated by an external Examiner.

Semester - IV								
ELE19405DCE: Computer Organization and Architecture							Course Category: DCE	
Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To study the basic organization and architecture of digital computers (CPU, memory, I/O, software).
- To get familiar with instruction set architecture, ALU and control unit design.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire knowledge about the structure of contemporary computers and develop an understanding of how computers execute arithmetic operations on both positive and negative numbers.
- Understand the foundational aspects of organizing, designing, and programming a basic digital computer, apart from getting introduced to a straightforward register transfer language for specifying diverse computer operations.
- Understand and apply computer arithmetic, the design of instruction sets, microprogrammed control units, pipelining and vector processing, memory organization, I/O systems, and multiprocessors.

Detailed Syllabus:

Unit I: Structure, Function and Measuring Performance

Computer Level Hierarchy and Evolution, Von-Neumann Architecture, Structure and Components of Computers, Computer Functions, Instruction Execution and Instruction Cycle State Diagrams, Bus Interconnection and Hierarchy, Elements of Bus Design, Bus Arbitration and Timings, Introduction to High speed buses. Measuring Performance – MIPS, FLOPS, CPI/IPC, Benchmark, Geometric and Arithmetic Mean, Speedup, Amdahl's and Moore's Laws.

Unit II: Memory Organization, Instruction Set Architecture and I/O Organisation

Memory Hierarchy, types and Characteristics, Primary Memory- Types, Working, Chip Organization, Expansion, Cache Memory- Mapping Schemes, Replacement Policies, Introduction to Virtual Memory, Overlays, Paging, Segmentation, RAID, Instructions and Instruction Set, Addressing Modes. CPU Registers – Organization, Programmer Visible, Status/Control, Accumulator, and general purpose registers, Stack based CPU, Micro-operations and RTL – Register Transfer, Arithmetic, logical and shift micro-operations, Implementation of simple Arithmetic, logical and shift units, Micro-operations and instruction execution, I/O Organization – I/O Module, its functions and structure.

Unit III: Data Representation, ALU and Control Unit Design

Scalar Data Types Sign Magnitude, One's and Two's Complement representations of Integers, Integer Arithmetic‟s (Negation, Addition, Subtraction, Multiplication, Division, Incrementation and Decrementation). Booths Algorithms and Hardware Implementation. Floating Pont Representation and IEEE Standards. Floating Point Arithmetic‟s (Negation, Addition, Subtraction, Multiplication and Division). ALU – Fixed and Floating point ALU Organization. Control Unit – Functional Requirements, Structure, Control Signals. Introduction to Pipelining and Parallel Processing.

Unit IV: Laboratory Work

The Laboratory work shall be based on units I through IV. It shall include digital design of binary adders, subtractors, comparators, fast adders, etc. Chip implementation of various arithmetical and logical circuits, Design of 4/8 bit ALU. Study of Booths algorithm and its hardware implementation, understanding format and representation of various data types in High and low level languages.

Books Recommended:

1. Computer Organization and Architecture by Stallings, PHI.
2. Computer Organization by M. Mano, PHI.
3. Computer Organization and Architecture by Gilmore, TMH.
4. Computer Organization and Design, Patterson Henessney, Harcourt India

Semester - IV ELE19406DCE: CMOS VLSI and Nano-Electronics –IV (Nanotechnology & Nano-electronics)								Course Category: DCE
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To make students learn about the fundamentals of nano-technology.
- To acquaint students with the issues of conventional MOS device at nanoscale.
- To introduce to students the various alternative devices proposed to replace MOSFET at nanoscale.
- To learn the application of the concepts of physics in nano-technology.
- To study the physics of nano-structures and devices.
- To study various alternative techniques for CMOS technology.
- To study the structure, operation, physics and characteristics of various opto-electronic devices.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the basic science behind the design and fabrication of nano scale systems.
- Understand and formulate new engineering solutions for current problems and competing technologies for future applications.
- Comprehend the fundamentals of nano-technology.
- Identify the issues of conventional MOS devices at nanoscale.
- Realize the alternative devices for the replacement of MOSFET at nanoscale.
- Comprehend operation and applications of various opto-electronic devices.

Detailed Syllabus:

Unit I: Nanotechnology and Nano-Electronics

Introduction to Nanotechnology: size dependant physical properties, Melting point, solid state phase transformations, excitons, band-gap variations-quantum confinement, effect of strain on band-gap in epitaxial quantum dots. The p-n junction and the bipolar transistor; metal semiconductor and metal insulator, Semiconductor junctions; field-effect transistors, MOSFETs

Unit II: Physics of Nanostructures

The Physics of Low-Dimensional Semiconductors: Square quantum well of finite depth, Parabolic and triangular quantum wells, Quantum wires, Quantum dots, Strained layers, Band structure in quantum wells, Semiconductor Quantum Nanostructures and Super-lattices: MOSFET structures, Hetero-junctions, Quantum wells, Super-lattices, Electric Field Transport in Nanostructures: Parallel transport, Perpendicular transport, Quantum transport in nanostructures, Transport in Magnetic Fields and the Quantum Hall Effect

Unit III: Electronic and Optoelectronic Devices Based on Nanostructures

HEMTs, MODFET, Hot Electron Transistors, Resonant Tunneling Transistor, Single Electron Transistor, Quantum Dots and Quantum Cellular Automata. Heterostructure semiconductor lasers ,Quantum well semiconductor lasers, Quantum dot lasers, Quantum well and super lattice photo detectors, Quantum well modulators, Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles.

Unit IV: Laboratory Work

The laboratory work shall include minimum 10 practicals across four units using suitable hardware/software platform.

Books Recommended:

1. Hari Singh Nalwa, Encyclopedia of Nanotechnology
2. Bharat Bhusan, Handbook of Nanotechnology, Springer
3. A. A. Balandin, K. L. Wang, Handbook of Semiconductor Nanostructures and Nanodevices
4. Cao, Guozhong, Nanostructures and Nanomaterials - Synthesis, Properties and Applications.
5. J. M. Martínez-Duart, R.J. Martín-Palma and F. Agulló-Rueda, Nanotechnology for Microelectronics and Optoelectronics, Elsevier B.V.

Semester - IV

ELE19407DCE: Wireless Cellular Communication **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To get the overview of wireless communication.
- To get familiar with multiple access techniques and mobile systems.

Learning Outcomes

After studying the course, the students shall be able to:

- Gain a comprehensive overview of wireless communication systems, including fundamental concepts, frequency reuse, cellular structures, interference management, and strategies for handoff.
- Understand the principles of cell sectoring, splitting, and various channel assignment techniques.
- Develop proficiency in digital modulation performance over wireless channels, diversity techniques, OFDM, and multiple access techniques.
- Gain insights into mobile systems and standards, including GSM, CDMA Cellular System (IS-95), and the evolution of 2G and 3G systems. Explore wireless local loop, Mobile IP, WLAN technology, and IEEE 802.11 WLAN standards.
- Apply theoretical knowledge in laboratory settings, implementing multiplexing techniques, calculating path loss, studying channel models, and gaining hands-on experience with GSM and CDMA cellular systems.
- Apply theoretical concepts to real-world scenarios, enhancing practical skills in the field of wireless communication.

Detailed Syllabus:

Unit I: Cellular System Fundamentals

Overview of Wireless Communication; Frequency Reuse and Cellular Concept; Co-Channel and Adjacent Channel Interferences; Cell Sectoring and Cell Splitting; Handoff Strategies; Channel Assignment Techniques.

Unit II: Modulation and Multiple Access Techniques

Performance of Digital Modulation over Wireless Channel; Diversity Techniques; Orthogonal Frequency Division Multiplexing (OFDM); Multiple Access Techniques: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Hybrid Techniques, OFDMA.

Unit III: Mobile Systems and Standards

Global System for Mobile Communications (GSM); CDMA Cellular System (IS-95); Evolution of Second-Generation (2G) Systems; Third-Generation (3G) Systems; Beyond 3G Systems. Wireless Local Loop; Mobile IP; Wireless Local Area Network (WLAN) Technology; IEEE 802.11 WLAN Standards; Ad Hoc Networking and Wireless Personal Area Networks.

Unit IV: Laboratory Work

Implementation of Multiplexing Techniques, Calculation of Path Loss, Co-relation, Power Spectral Density, Study of various Channel Models, Study of GSM and CDMA Cellular Systems.

Books Recommended:

1. Wireless Communication; Principles and Practice; T.S.Rappaport
2. Principles of Mobile Communication, G.LStuber Kluwer Academic, 1996.
3. Wireless and Digital Communications; Dr. KamiloFeher (PHI)
4. Mobile Communication Hand Book; 2nd Ed.; IEEE Press
5. Mobile Communication Engineering – Theory & Applications; TMH

Semester - IV

ELE19408DCE: Multimedia Technology and Security **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To get familiarized with multimedia systems.
- To be able to identify various security issues in Multimedia
- To understand various multimedia compression techniques and standards.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the principles of multimedia technology and its components.
- Apply multimedia authoring tools to create engaging content.
- Identify security threats in multimedia applications and systems.
- Implement encryption and DRM mechanisms to protect multimedia content.
- Demonstrate ethical and legal considerations in multimedia creation and distribution.
- Develop practical skills in designing secure multimedia delivery systems.

Detailed Syllabus:

Unit I: Introduction to Multimedia Systems and Processing

Introduction to multimedia systems, Multimedia signals, various sources of multimedia signals, Motivation for growth of multimedia theory, different elements of multimedia communication system, Challenges involved with multimedia signal processing and communication, Image and Video Formation, Video Formation Model, Sampling and Quantization, Image/Video filtering Point Processing and Mesh Processing.

Unit II: Multimedia Compression

Redundant information in images. Lossless and lossy image compression. Elements of an image compression system, Huffman coding. Limitations of Huffman coding. Arithmetic coding (Basic principal). Encoding and Decoding procedure of an arithmetic coded bitstream. Coding limitations of arithmetic coding. Introduction to Lempel-Ziv and Run length coding. Theory of Quantization, uniform and non-uniform quantization, scalar and vector quantization. Lloyd- Max quantizer .Rate-distortion function, Lossy predictive coding. Pixel encoding using Delta modulation, source coding theorem.

Unit III: Information Security

Need for information security, Information Hiding versus Encryption, Requirements of a Data Hiding System, Hiding Capacity, Robustness and Imperceptibility, Steganography and watermarking. Hiding in Spatial and Frequency domains. Advantages and disadvantages of spatial and frequency domain embedding. LSB based embedding algorithm for data hiding.

Unit IV: Laboratory Work

Introduction to image processing toolbox. Frequently used commands for image manipulation (IMSHOW, IMREAD, IMWRITE, RAND, RANDN, RANDPERM etc.), Image encryption using MATLAB Implementation of LSB and ISB algorithms, Frequency domain data hiding in MATLAB.

Books Recommended:

1. Shuman and Thomson, Introduction to Multimedia, Tata Mcgrah Hill 2007.
2. Gonzalez and Woods, "Digital Image Processing", 2 Ed, Pearson Education, 2002.

3. N. J. Fliege, Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets, Wielypublishers ,1999
4. Lu, S.: Multimedia security: Stegnography and digital watermarking techniques for protection of intellectual property, Idea Group Publishing, USA. (2005).

Semester - IV

ELE19409DCE: Fundamentals of RF Circuit Design **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To acquaint the students with the issues of design at high frequencies.
- To study the importance of RF design and its modeling.
- To acquaint students with various RF communication devices and their applications.

Learning Outcomes

After studying the course, the students shall be able to:

- Gain a comprehensive understanding of passive components when operating at radio frequency (RF) frequencies, along with the necessary circuit theory and effect of parasitic.
- Utilize graphical design methodologies, incorporating the application of the Smith Chart, to enhance the visual representation and planning of designs.
- Employ meticulous impedance matching techniques and execute impedance transformations with precision and attention to detail.
- Leverage performance metrics like Signal-to-Noise Ratio (SNR) and Bit Error Rate (BER) to gain insights into the limitations of system performance.
- Create budget profiles for wireless communication systems along with computation of propagation losses and link budgets.
- Evaluate considerations regarding the balance between cost and performance and assess the performance of various RF wireless system architectures.

Detailed Syllabus:

Unit I: Introduction to RF Design and Modelling

Importance of RF Design, RF Behaviour of Passive Components, Chip Components and Circuit Board Considerations, General Transmission Line Equation, Micro Strip Transmission Lines, Single and Multi-Port Networks. RF Diode, Bipolar Junction Transistor, RF Field Effect Transistors, High Electron Mobility Transistor, Diode Models, Transistor Models, Characteristics of Amplifiers, Amplifiers Power Relation, Stability Considerations.

Unit II: RF Filter and Oscillator Design

Overview of RF Filter design, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise, Amplifier design in various technologies, Power Amplifier design, Design issues in integrated RF filters. Basic Oscillator Model, High Frequency Oscillator Configuration.

Unit III: RF Communication Devices

Basic Characteristics of Mixers. Various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Resonator VCO. designs, Radio frequency Synthesizers - PLL, Various RF Synthesizer architectures and frequency dividers.

Unit IV: Laboratory Work

The laboratory work shall include minimum 10 practicals across four units using suitable hardware/software platform.

Books Recommended:

1. Reinhold Ludwig, PavelBretchko, RF Circuit Design, Pearson Education Asia, 2001.
2. B Razavi, Design of Analog CMOS Integrated Circuit, McGraw Hill, 2000.
3. R. Jacob Baker, H.W. Li, D.E. Boyce, CMOS Circuit Design, layout and Simulation, PHI 1998.

4. Y.P. Tsividis, Mixed Analog and Digital Devices and Technology, TMH 1996
5. Thomas H. Lee, Design of CMOS RF Integrated Circuits, Cambridge University Press 1998.

Semester - IV

ELE19410DCE: Biomedical Instrumentation **Course Category: DCE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
3	0	1	4	20	60	20	100	1 ¾ Hours

Learning Objectives:

- To introduce to the importance and applications of biomedical devices.
- To understand the use of electronic sciences in biomedical devices.
- To familiarize students with various medical equipments and their technical aspects.
- To introduce to the students the trends in biomedical instrumentation.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the principles and applications of biomedical instrumentation in healthcare.
- Identify biomedical sensors and their working principles.
- Analyse signal acquisition and processing techniques.
- Demonstrate proficiency in device calibration and validation.
- Apply safety considerations and regulatory requirements.
- Design basic circuits for signal conditioning and amplification in biomedical instrumentation.

Detailed Syllabus:

Unit I: Electro-Physiology, Bio-Potential Recording, BioChemical and Non-Electrical Parameter Measurement

The origin of Biopotentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics. PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, hearing aids, respiratory measurement, oximeter, Blood pressure,Temperature, pulse, Blood cell counters.

Unit II: Assist Devices, Bio-Telemetry and Recent Trends

Cardiac pacemakers, DC Defibrillator, physiotherapy, diathermy, nerve stimulator, artificial kidney machine. Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation.

Unit III: Medical Imaging

Medical imaging, X-rays, laser applications, ultrasound scanner, Echo-Cardiography, CT Scan MRI/NMR, cine angiogram, colour Doppler systems, Holter monitoring, endoscopy.

Unit IV: Laboratory Work

Measurement of blood pressure, study of ECG and EEG lead systems, study of ECG and EEG graphs, temperature measurement, Respiratory measurement.

Books Recommended:

1. Leislie Cromwell, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi, 2002.
2. Khandpur, R.S., Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 1997.
3. Joseph J. Carr and John M. Brown, Introduction to Biomedical equipment Technology, John Wiley and Sons, New York, 1997.

Semester - IV ELE19411DCE: Digital Image Processing									Course Category: DCE
Credits			Total Credits	Maximum Marks					Time Allowed for Theory Examination
				Internal	End Term		Total		
Lecture	Tutorial	Practical			Theory	Lab			
3	0	1	4	20	60	20	100		1 ¾ Hours

Learning Objectives:

- To understand image formation model and various image types.
- To understand basic manipulation operations for images including Image Transformation
- To understand image enhancement in spatial and frequency domain.
- To have a deep insight with regard to need for image compression and various approaches to achieve image compression.

Learning Outcomes

After studying the course, the students shall be able to:

- Acquire a robust understanding of fundamental concepts within digital image processing systems.
- Understand the essentials of color image fundamentals and models.
- Comprehend the various image enhancement operations, demonstrating their capacity to refine and improve visual information through sophisticated processing techniques.
- Design and analyse image compression systems, equipping them with the skills to efficiently manage and store digital images.
- Navigate the complexities of digital image processing, preparing them for practical applications in fields such as computer vision and image analysis.
- Develop the capability to create algorithms for image filtering, enhancement, and compression using MATLAB.

Detailed Syllabus:

Unit I: Digital Image Fundamentals

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry. Review of matrix theory results: Row and column ordering. Review of Image transforms: 2D-DFT, FFT.

Unit II: Image Enhancement

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering.

Unit III: Image Compression

Image compression: fundamentals- redundancy: coding, inter pixel, psychovisual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG and MPEG. Image Compression using MATLAB.

Unit IV: Laboratory Work

Introduction to Image processing Toolbox. Frequently used commands in image processing. Algebraic operations on image data. Image filtering and restoration using MATLAB. Image compression using MATLAB.

Books Recommended:

1. Gonzalez and Woods, "Digital Image Processing", 2 Ed, Pearson Education, 2002.
2. Anil K. Jain "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3. Mark Nelson, Jean-Loup Gailly "The Data compression Book" 2 Ed, bpb Publications.
4. Pratt William K.,"Digital Image Processing", John Wiley & sons
5. M.Sonka,V. Hlavac, R. Boyle, "Image Processing, Analysis and Machine Vision", Vikas Publishing House

Semester - IV								
ELE19412DCE: Cyber Security and Forensics							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To get introduced with security threats.
- To provide an understanding of Computer forensics fundamentals.
- To analyze various computer forensics technologies.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand basic concepts, terminology, principles, and methods of cyber security.
- Get familiarized with wide range of technologies, available tools, and practical approaches in cyber security and forensics.
- Develop basic understanding of web security attacks and defences against them.
- Understand different types of forensics, Cyber Crime Investigations and Digital Forensics, Cyber Laws and Security Policies.

Detailed Syllabus:

Unit I: Introduction to Security Threats

Intruders and Hackers, Insider threats, Cybercrimes. Network Threats: Active/ Passive, Worms, Virus, Spam's, Ad ware, Spy ware, Trojans and covert channels. Backdoors, Bots. Spoofing. Internal treats Environmental threats, phishing, and cross-site scripting (XSS), Code injection, Sybil attack, Distributed Denial of Service and other network attacks. Systems Security, Pharming Attacks, IP Spoofing port scanning, DNS Spoofing, SYNattacks, Smurf, attacks, UDP flooding.

Unit II: Web and Email Security

Intrusion Detection and Prevention, Web security requirements, XML, SOAP, WSDL and UDDI, WS Security, SAML, WS-Security Policy, Secure Sockets Layer (SSL), Transport Layer Security (TLS), and Secure Electronic Transaction (SET), HTTPS, Secure Shell (SSH), IP Security: IP Security overview, Architecture, Authentication, Multipurpose Internet Mail Extensions, S/MIME Functionality, S/MIME Messages, Enhanced Security Services, Domain Keys Identified Mail: Internet Mail Architecture, E-mail Threat.

Unit III: Forensics

Forensic Types: Disk Forensics, Network Forensics, Mobile Device Forensics, Live Forensics, Memory Forensics, Multimedia Forensics, Internet Forensics, Cyber Crime Investigations and Digital Forensics, Cyber Laws and Security Policies, Cybercrime, Forensic process, Legal process and Law enforcement, ACPO guidelines, Digital evidence, Investigative tools (Open Source and Proprietary), Email & Browsers, Intrusion detection, Attack trace-back, Packet inspection, Log analysis, Hashing issues, Cloud computing., Using Forensic Software such as FTK, Encase etc.

Unit IV: Laboratory Work

The laboratory work shall be based on unit I through unit IV and shall use hardware study as well as experiments using simulations.

Books Recommended:

1. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications Taylor & Francis Group.
2. AnkitFadia "Ethical Hacking" 2nd Edition Macmillan India Ltd.
3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council Press Series: Computer Forensics).
4. John W. Rittinghouse, William M. Hancock, "Cyber security Operations Handbook", ElsevierPub.

Semester - IV								
ELE19413DCE: Broadband Wireless Networks							**Course Category: DCE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
3	**0**	**1**	**4**	**20**	**60**	**20**	**100**	**1 ¾ Hours**

Learning Objectives:

- To review broadband communication.
- To get brief idea of 3G cellular systems and multi-carrier systems.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Gain a comprehensive understanding of broadband communication networks, including DSL, ADSL, HDSL, SDSL, and VDSL
- ➢ Acquire a brief overview of 3G cellular systems, WiFi systems, and the comparison between WiMAX, 3G, and WiFi technologies.
- ➢ Understand spectrum options for broadband wireless, as well as the business and technical challenges associated with broadband wireless and WiMAX.
- ➢ Explore beyond 3G technologies, focusing on multicarrier systems such as WiMAX (IEEE 802.16).
- ➢ Apply theoretical knowledge through laboratory work, studying broadband networks using network and RF communication tools.
- ➢ Develop practical insights into broadband wireless technologies, including WiMAX and other comparable systems.

Detailed Syllabus:

Unit I: Broadband Networks and Generations

Review of Broadband communication networks DSL, ADSL, HDSL, SDSL, VDSL, Introduction to Broadband Wireless, Evolution of broadband Wireless, Emergence of Standard Based Technology, Mobile Broadband Wireless: Market Drivers and Applications, WiMAX and Other Broadband Wireless Technologies.

Unit II: 3G Standards

Brief of 3G cellular systems, WiFi Systems, WiMAX versus 3G and WiFi, Other comparable systems, Spectrum options for broadband wireless, Business and technical challenges of broadband wireless and WiMAX.

Unit III: Beyond 3G – Multicarrier Systems

Overview of WiMAX: IEEE 802.16 and WiMAX, Salient features of WiMAX, WiMAX Physical and MAC layer Overview, OFDM Basics, OFDM in WiMAX, Advanced features for performance improvement, WiMAX Reference Network Architecture, Handoff Mechanism, Different types of Services, QoS Architecture.

Unit IV: Laboratory Work

Study of broad band networks using network and R.F. Communication tools

Books Recommended:

1. Jeffrey G. Andrews, Arunabha Ghosh and Rias Muhamed, "Fundamentals of WiMAX: understanding broadband wireless networking", Pearson Education, 2007.
2. Mobile WiMAX : toward broadband wireless metropolitan area networks / editors, Yan Zhang and Hsiao-Hwa Chen, Auerbach Publications, 2007.

Semester - IV								
ELE19013GE: Foundations of Computer Organization							**Course Category: GE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
1	**0**	**1**	**2**	**10**	**20**	**20**	**50**	**½ Hours**

Learning Objectives:

- To understand the hierarchy of computers.
- To get familiar with data representation, ALU and Control unit design.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Comprehend the principles of computer organization and fundamental architectural concepts.
- ➢ Cultivate an in-depth comprehension of the architecture and operations of the central processing unit.
- ➢ Illustrate effectively the memory organization in a computer system.
- ➢ Acquire knowledge I/O device communication with the Processing Unit and familiarize yourself with the characteristics of multiprocessors.

Detailed Syllabus:

Unit I: Structure, Function and Measuring Performance

Computer Level Hierarchy and Evolution, Von-Neumann Architecture, Structure and Components of Computers, Computer Functions, Instruction Execution and Instruction Cycle State Diagrams, Computer Buses, Bus Interconnection and Hierarchy, Elements of Bus Design, Bus Arbitration and Timings, introduction to High speed buses. Measuring Performance – MIPS, FLOPS, CPI/IPC, Benchmark, Geometric and Arithmetic Mean, Speedup, Amdahl's and Moore's Laws.

Unit II: Data Representation, ALU and Control Unit Design

Scalar Data Types Sign Magnitude, One's and Two's Complement representations of Integers, Integer Arithmetic's (Negation, Addition, Subtraction, Multiplication, Division, Incrementation and Decrementation). Booths Algorithms and Hardware Implementation. Floating Pont Representation and IEEE Standards. Floating Point Arithmetic's (Negation, Addition, Subtraction, Multiplication and Division). ALU – Fixed and Floating point ALU Organization. Control Unit – Functional Requirements, Structure, Control Signals. Introduction to Pipelining and Parallel Processing.

Books Recommended:

1. Computer Organization and Architecture by Stallings, PHI
2. Computer Organization by M. Mano, PHI.
3. Computer Organization and Architecture by Gilmore, TMH.
4. Computer Organization and Design, Patterson Henessney, Harcourt India

Semester - IV

ELE19014GE: Mobile Communication **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To get an overview of wireless communication.
- To understand multiple access techniques and mobile systems.
- To understand and familiarize with various cellular standards.

Learning Outcomes

After studying the course, the students shall be able to:

- ➢ Develop a comprehensive understanding of wireless communication systems, covering fundamental concepts, frequency reuse, cellular structures, multiple access techniques and strategies for mitigating interferences.
- ➢ Acquire proficiency in cellular system fundamentals, including the cellular concept, handoff strategies, and channel assignment techniques.
- ➢ Gain a comprehensive understanding of various mobile systems and standards, including GSM, CDMA

Cellular System (IS-95), and the evolution of 2G and 3G systems.
- Explore beyond 3G systems, wireless local loop, Mobile IP, WLAN technology, IEEE 802.11 WLAN standards, ad hoc networking, and wireless personal area networks.
- Develop the ability to analyze and design effective mobile communication systems using different standards and technologies.
- Understand the practical implementation and considerations for WLANs in various environments.

Detailed Syllabus:

Unit I: Cellular System Fundamentals

Overview of Wireless Communication; Frequency Reuse and Cellular Concept; Co-Channel and Adjacent Channel Interferences; Cell Sectoring and Cell Splitting; Handoff Strategies; Channel Assignment Techniques. Multiple Access Techniques: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Hybrid Techniques, OFDMA.

Unit II: Mobile Systems and Standards

Global System for Mobile Communications (GSM); CDMA Cellular System (IS-95); Evolution of Second-Generation (2G) Systems; Third-Generation (3G) Systems; Beyond 3G Systems. Wireless Local Loop; Mobile IP; Wireless Local Area Network (WLAN) Technology; IEEE 802.11 WLAN Standards; Ad Hoc Networking and Wireless Personal Area Networks.

Books Recommended:

1. Wireless Communication; Principles and Practice; T. S. Rappaport
2. Principles of Mobile Communication, G.L Stuber Kluwer Academic, 1996.
3. Wireless and Digital Communications; Dr. Kamilo Feher (PHI)
4. Mobile Communication Hand Book; 2nd Ed.; IEEE Press
5. Mobile Communication Engineering – Theory & Applications; TMH

Semester - IV

ELE19015GE: Fundamentals of Bio Medical Instrumentation **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To familiarize students with various medical equipments and their technical aspects.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the core principles and applications of biomedical instrumentation.
- Identify various types of biomedical sensors and their functions.
- Analyze signal acquisition and processing methods used in biomedical instrumentation.
- Demonstrate proficiency in calibrating and validating biomedical devices.
- Apply safety protocols and regulatory standards relevant to biomedical instrumentation.
- Design basic circuits for signal conditioning and amplification in biomedical devices.

Detailed Syllabus:

Unit I: Electro-Physiology, Bio-Potential Recording, Bio-Chemical and Non Electrical Parameter Measurement

The origin of Biopotentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics, PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Blood flow meter, hearing aids, oximeter, Blood pressure, Temperature, pulse, Blood cell counters.

Unit II: Assist Devices, Bio-Telemetry and Recent Trends

Cardiac pacemakers, DC Defibrillator, physiotherapy, diathermy, nerve stimulator, artificial kidney machine. Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation.

Books Recommended:
1. Leislie Cromwell, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi, 2002.
2. Khandpur, R.S., Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, 1997.
3. Joseph J. Carr and John M. Brown, Introduction to Biomedical equipment Technology, JWS, New York, 1997.

Semester - IV

ELE19016GE: Principles of Digital Image Processing **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:
- To understand fundamentals of digital image processing.
- To get acquainted with the knowledge of Image enhancement and restoration
- To understand need for compression and various compression models.

Learning Outcomes

After studying the course, the students shall be able to:
- Comprehend basic concepts of digital image processing.
- Critically evaluate techniques related to image enhancement, demonstrating their ability to analyse and improve visual data.
- Categorize various compression techniques, providing them with a comprehensive knowledge of methods to efficiently store and transmit digital images.
- This course will empower students with the essential skills to navigate the intricacies of digital image processing, enabling them to make informed decisions and apply appropriate techniques in diverse applications.

Detailed Syllabus:

Unit I: Digital Image Fundamentals

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry. Review of matrix theory results: Row and column ordering. Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters.

Unit II: Image Compression

Image compression: fundamentals- redundancy: coding, inter pixel, psychovisual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- Lossy predictive, transform coding. Fundamentals of JPEG and MPEG. Image Compression using MATLAB

Books Recommended:
1. Gonzalez and Woods, "Digital Image Processing", 2 Ed, Pearson Education, 2002.
2. Anil K. Jain "Fundamentals of Digital Image Processing", Pearson Education, 2003.
3. Mark Nelson, Jean-Loup Gailly "The Data compression Book" 2 Ed, BPB Publications.
4. Pratt William K.,"Digital Image Processing", John Wiley & sons

Semester - IV

ELE19017GE: Internet of Things (IOT) **Course Category: GE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To understand the concepts behind the Internet of things.
- To get an overview of IOT architectures.

Learning Outcomes

After studying the course, the students shall be able to:

- Understand the fundamental concepts and principles of the Internet of Things (IoT).
- Identify key components and technologies used in IoT systems.
- Analyze different communication protocols and networking architectures relevant to IoT.
- Demonstrate proficiency in developing IoT applications using sensors, actuators, and microcontrollers.
- Apply data analytics techniques to extract insights from IoT-generated data.
- Design and implement security mechanisms to protect IoT devices and networks

Detailed Syllabus:

Unit I: Introduction

Introduction to concepts behind the Internet of Things, Review of technologies enabling IoT- Sensors, Networks, Standards, Augmented intelligence and Augmented behavior, Applications of internet of things, IoT Communication Pattern and Layering concepts, Cellular IoT, IoT cloud.

Unit II: IoT Architectures, Models and Protocols

Overview of IoT architectures (European FP7, WSO2, IVM, CISCO, IoT-A, RAMI4.0, IIRA),IEEE P2413 reference architecture model, Functions of application, network, adaptation, MAC and PHY layers, IoT protocol stack verses traditional protocol stack, Introduction to various IOT protocols (CoAP,6LoWPAN,MQTT,RPL, IEEE 802.15.4, DTLS, ROLL).

Books Recommended:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems Dr. O. Vermesan , Dr. Peter Friess, River Publishers.
2. Interconnecting Smart Objects with IP: The Next Internet, Jean Philippe Vasseur, Adam Dunkels, Morgan Kuffmann.
3. Internet of Things (A Hands on approach), Vijay Madisetti, Arshdeep Bahga.
4. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally.

Semester - IV

ELE-19007OE: Computing and Informatics - IV | **Course Category: OE**

Credits			Total Credits	Maximum Marks				Time Allowed for Theory Examination
				Internal	End Term		Total	
Lecture	Tutorial	Practical			Theory	Lab		
1	0	1	2	10	20	20	50	½ Hours

Learning Objectives:

- To familiarize students with computer networks, search engines, social networking sites, creating emails etc.

Learning Outcomes

After studying the course, the students shall be able to:

- Gain proficiency in computer networks, understanding the concepts of LAN, WAN, and MAN.
- Develop effective skills for using the Internet, including a comprehensive understanding of web addressing, URLs, and various types of internet connections.
- Gain practical knowledge of different connection types, such as dial-up and broadband (ISDN, DSL, Cable).
- Become competent in internet browsing, search engine usage, and exploring portals.
- Develop skills in creating and managing emails, including reading, saving, printing, forwarding, and deleting emails. Understand email etiquette and the use of cc and bcc in addressing.
- Gain practical hands-on experience in Lab Work, working with various browsers, email platforms, downloading and uploading data, social networking sites, search engines, video conferencing and different document types.

Detailed Syllabus:

Unit I: Introduction

Introduction to Computer Networks, LAN, WAN, MAN, Network topologies, Definition & History of Internet - Uses of Internet - Definition of Web-Addressing-URL-Different types of Internet Connections; Dial up connection, Broad band (ISDN,DSL, Cable), browsers and its types, internet browsing, searching - Search Engines - Portals - Social Networking sites- Creating an email-ID, e-mail reading, saving, printing, forwarding and deleting the mails, checking the mails, viewing and running file attachments, addressing with cc and bcc.

Unit II: Lab Work

Working with different type of browsers, E-mails, downloading and uploading of data, social networking, search engines and document types, video conferencing.

Books Recommended:

1. Hasan. A. Sadek "BIOINFORMATICS Principles and Basic Internet Applications" Traford Publishing
2. O. H. U. Heathcote "Basic Internet" 3rd Edition, Payne Gallway Publishing
3. Wendell Odorn "Computer Networking First step" Cisco Press

Semester - IV								
ELE19008OE: Electronic Devices and Circuits -IV							**Course Category: OE**	
Credits			**Total Credits**	**Maximum Marks**				**Time Allowed for Theory Examination**
				Internal	**End Term**		**Total**	
Lecture	**Tutorial**	**Practical**			**Theory**	**Lab**		
1	**0**	**1**	**2**	**10**	**20**	**20**	**50**	**½ Hours**

Learning Objectives:

- To understand the operation of bipolar junction transistor.
- To know about the process of amplification and classification of amplifiers.

Learning Outcomes

After studying the course, the students shall be able to:

- Comprehend the operation and applications of bipolar junction transistor (BJT) and Metal Oxide Semiconductor Field effect Transistor.
- Know the characteristics of transistors
- To study different biasing techniques to operate transistor, FET, and MOSFET in different modes.
- Know the benefits of feedback in amplifier.

Detailed Syllabus:

Unit I: Bipolar Junction Transistor (BJT)

Bipolar Junction Transistor (BJT), Types of transistors, Symbol, Biasing of transistor, transistor Configurations. ALPHA & BETA of a transistor. Introduction to JFET and MOSFET.

Unit II: Amplifiers and Oscillators

Amplification, Transistor as an amplifier. Classification of Amplifiers, Class A, B.C. Power amplifier, Impedance matching. **Oscillators,** importance, applications to electrical circuits. Factors controlling oscillation. Types of Oscillators, A.F and R.F Oscillators, Crystal Oscillator, Oscillators used in Radio circuits.

Lab Work:

- Testing a Transistor.
- Terminal determination.
- Calculation of Alpha and Beta.
- Transistor configurations.
- Finding the I-V characteristics of BJT.
- Transistor as an amplifier.
- Finding the I-V characteristics of JFET.
- Finding the I-V characteristics of MOSFET.
- Study of various Oscillators.

Books Recommended:

1. Boylstead, Electronic Devices and Circuit Theory.
2. Sedra and Smith, Microelectronic Circuits.