Syllabus for

B.E. V & VI – Semester

for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

V Semester Syllabus

SUBJECT CODE: 21UEC501C	Digital Signal Processing	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, properties: multiplication of two DFTs, circular convolution and additional properties of DFT. Application of DFT in linear filtering: overlap add and overlap save method.	
UNIT–II	**10 Hrs.**
Fast Fourier Transform Algorithms: Need for efficient computation of DFT, Radix 2 FFT algorithms for computation of DFT and IDFT: Decimation in time and decimation in frequency algorithms. Goertzel algorithm and chirp-Z transform algorithm.	
UNIT–III	**10 Hrs.**
IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters. Design of IIR filters from analog filters (i.e. Butterworth and Chebyshev), Transformation techniques: Impulse invariance method, Approximation of derivative (Backward difference and Forward difference) method. Bilinear transformation method.	
UNIT–IV	**10 Hrs.**
FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing (Rectangular, Hamming, Hanning and Bartlet) method, FIR filter design using frequency sampling method. Implementation of discrete time systems - Structures for IIR and FIR systems: Direct form I, Direct form II, Cascade and Parallel realization.	

Reference Books *

Textbook:

1. Proakis and Manolakis, “Digital Signal Processing-Principles Algorithms and Applications” PHI Publication, III Edition, 1997.

Reference Books:

1. Oppenheim and Schaffer, “Discrete Time Signal Processing” PHI Publication, III Edition, 2003.

Course Outcomes**

After completion of the course student will be able to

1. **Compute and use DFT for linear filtering applications.**
2. **Calculate DFT and IDFT using FFT and IFFT algorithms.**
3. **Design IIR filters using Butterworth and Chebyshev approximations and draw their structures.**
4. **Design FIR filters using windowing and frequency sampling techniques and draw their structures.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course	Programme Outcomes (POs)	Program Specific

Outcomes													Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	0	1	0	0	0	0	0	0	0	3	0	0
CO2	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0
CO3	3	3	3	0	1	0	0	0	0	0	0	0	3	0	0
CO4	3	2	3	0	1	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC502C	Control Engineering	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

System modeling: Definition of control system, Concept of feedback and its significance, open loop and closed loop systems, Modeling of Electrical, Mechanical and Electromechanical systems, Differential equations of physical system. Transfer function, Block diagram representation and Reduction technique, Signal flow graph representation and reduction using Mason's gain formula.

UNIT–II	xx Hrs.

Time domain analysis of control systems: Introduction, standard test signals, Unit step response of a second order system, Steady state error analysis, time domain specifications. Stability analysis technique: Concept of stability, Location of Roots in the s-plane for stability, methods of determining stability, Routh-Hurwitz stability criterion.

UNIT–III	xx Hrs.

Root-Locus Technique: Introduction, Procedure for constructing Root-locus. Stability analysis using root locus. Frequency Domain Analysis: Introduction, Bode plots, Gain and Phase cross over frequency, gain margin, phase margin, Frequency domain specifications-resonant peak, resonant frequency, and bandwidth.

UNIT–IV	xx Hrs.

Polar plots, Nyquist stability criterion; Principle of argument, mapping, Nyquist path, Nyquistcriterion, Nyquist Plot and stability analysis. State Space Analysis: Introduction, concept of state and variables, state model, Non homogeneous solution of a state equation.

Reference Books *

1. Nagrath and Gopal, "Control System Engineering", New Age publication.
2. K. Ogeta, "Modern control engineering", Person education, Asia/PHI 4th edition, 2002.
3. Benjamin C.Kuo, "Automatic Control Systems", PHI 7th edition.
4. Richard C. Dorf and Robert. H. Bishop, "Modern Control Systems", Person Education, 8 thEdition, 2002.
5. M. Gopal, "Control Systems-Principles and Design", TMH, 2nd Edition, 2002.
6. David. K. Chng, "Analysis of Linear systems", Narosa publishing house, 1996

Course Outcomes**

After completion of the course student will be able to

1. Mathematically model electrical, mechanical and electromechanical control systems.
2. Characterize the control systems in time domain.
3. Analyze stability of a control system using root locus technique and frequency domain analysis using Bode plotting techniques.
4. Determine the stability of control systems using polar and Nyquist plotting technique and represent the control systems using state space techniques.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

SUBJECT CODE: 21UEC503C	CMOS Digital VLSI Design	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction: A Brief History, Preview, MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning. **MOS Transistor Theory:** Introduction, Long- Channel I-V Characteristics, C-V Characteristics (simple MOS capacitance models), Non ideal I-V Effects, DC Transfer Characteristics. **CMOS Processing Technology:** Introduction, CMOS Technologies.	
UNIT–II	**10 Hrs.**
Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model (Logical effort, parasitic delay, delay in logic gate, drive), Logical Effort of Paths, **Power:** Introduction, Dynamic Power, Static Power.	
UNIT–III	**10 Hrs.**
Interconnect: Introduction (wire Geometry), Interconnect Modeling, Interconnect Impact (Delay, Energy, Cross talk). **Combinational Circuit Design:** Introduction, Circuit families, Silicon-On-Insulator Circuit Design.	
UNIT–IV	**10 Hrs.**
Sequential Circuit Design: Introduction, Circuit Design of Latches and Flip Flops (conventional CMOS latches, conventional CMOS flip flops, pulsed latches, resettable latches and flip flops, enabled latches and flip flops, incorporating logic into latches, dual edge triggered flip flops. **Array Subsystems:** Introduction, SRAM (SRAM cells, ROW circuitry, column circuitry), Read-Only Memory, Serial Access Memories, Content Addressable Memory, Programmable Logic Arrays.	

Reference Books *

Text Book:

1. Neil H. E. Weste, David Harris "CMOS VLSI Design A Circuits and Systems Perspective"
2. Pearson Education Publisher, Fourth Edition, 2015.

Reference Books:

1. Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic "Digital Integrated Circuits A Design
2. Perspective" Pearson Education Publisher, Second Edition. 2010.
3. John P Uyemura "Introduction to VLSI Circuits and Systems" Wiley Publication 2002.
4. R. Jcob Baker, Harry W. Li and David E Boyce "CMOS Circuit Design, Layout, and Simulation"

Course Outcomes**

After completion of the course student will be able to

1. **Draw the layout of CMOS circuits; apply the knowledge of fabrication processes and MOSFET transistors in VLSI design.**

2. **Draw RC equivalent circuit of CMOS circuits and estimate delay and power.**
3. **Model & design of interconnects in chips, design of combinational circuits.**
4. **Design basic buildings of sequential and memory blocks using MOSFET transistors.**

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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	0	0	0	0	0	0	0	0	0	3	1	0
CO2	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO4	3	3	3	0	0	1	2	0	0	0	0	0	3	2	0

SUBJECT CODE: 21UEC504L	VLSI Laboratory	Credits: 01
L:T:P – 0-0-3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

NAME OF THE EXPERIMENT
Design following CMOS/TG based circuits with given specifications* and complete the VLSI design flow mentioned below using appropriate tool: a) Draw the schematic and verify the following i) DC Analysis ii)Transient Analysis b) Draw the Layout and verify the DRC,ERC c) Check for LVS d) Extract RC and back annotate the same and verify the design. 1) CMOS inverter 2) CMOS two input NAND gate 3) CMOS two input NOR gate 4) CMOS two input OR gate 5) CMOS two input AND gate 6) TG based two input XOR and XNOR gates 7) Negative edge triggers D flip flop using TGs and inverters 8) 4:1 MUX using TGs and inverters 9) 3- Bit up counter 10 3-Bit SISO shift register **An appropriate constraint should be given*
Course Outcomes**
After completion of the course student will be able to **1. Design CMOS/ TG based gates, MUX, flipflops, counters and shift register.** **2. Draw the layout, run DC and transient analysis for designed CMOS standard cells.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0
CO2	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC505E	JAVA Programming	Credits:03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Introducing classes, Objects and Methods: Introducing Classes, Class Fundamentals, The GeneralForm of a Class, A Simple Class, Declaring Objects, A Closer Look at new, Assigning Object Reference Variables, Introducing Methods, Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameter , Constructors, Parameterized Constructors, The this Keyword, The finalize( ) Method, A Stack Class. A Closer Look at Methods and Classes : Overloading Methods , Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited,Introducing Nested and Inner Classes, Exploring the String Class, Using CommandLine Arguments.	
UNIT–II	**xx Hrs.**
Inheritance: Inheritance, Inheritance Basics, Member Access and Inheritance, Example, A Super class Variable Can Reference a Subclass Object, Using super, Using super to Call Super class Constructors, A Second Use for super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Why Overridden Methods?, Applying Method Overriding. Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding, Using final to Prevent Inheritance, The Object Class. Packages and Interfaces: Packages, Defining a Package, Finding Packages and CLASS PATH, A Short Package Example, Access Protection, An Access Example, Importing Packages, Interfaces,Defining an Interface, Implementing Interfaces, Nested Interfaces.	
UNIT–III	**xx Hrs.**
Exception Handling : Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Displaying a Description of an Exception, Multiple catch Clauses , Nested try Statements, throw, throws, finally, Java's Built-in Exceptions , Creating Your Own Exception Subclasses, Using Exceptions . Multithreaded Programming : The Java Thread Model, Thread Priorities, Synchronization, Messaging, The Thread Class and the Runnable Interface, The Main Thread, Creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, Using is Alive( ) and join( ).	
UNIT–IV	**xx Hrs.**
Multithreaded Programming Continuous: Thread Priorities, Inter thread Communication, Deadlock, Suspending, Resuming, and Stopping Threads, Suspending, Resuming, and Stopping Threads. The Applet Class :Two Types of Applets, Applet Basics, The Applet Class, Applet Architecture,An Applet Skeleton, Applet Initialization and Termination, Overriding update( ), Simple Applet Display Methods, A Simple Banner Applet, Using the Status Window, The HTML APPLET Tag, Passing Parameters to Applets, get Document Base( ) and get Code Base( ), Applet Context and show Document( ), The Applet Stub Interface .	

Reference Books *

1. From Complete Reference, “The Complete Reference” 7th edition
2. E. Balagururusamy, “Program with JAVA” 4th edition
3. Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehensive Introduction” McGraw Hill
4. The JAVA tutorials, 4th Edition by SUN Microsystems

Course Outcomes**

After completion of the course student will be able to

1. **Use fundamentals of class, objects, methods, operators, constructors.**
2. **Write programs using Inheritance, Super class, methods overriding, object class, final key,packages & interfaces in java code.**
3. **Handling Exceptions fundamentals, exception hierarchy, exception JAVA Programming fundamentals & Multithreaded Programming concepts.**
4. **Establish Inter thread communication, set thread priorities, solve deadlock , operations of suspend(),resume(), Stop(). Programming for applets.**

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

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Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	0	0	0	2	1	0	0	0	0	1	2	0	2
CO2	3	2	0	0	0	1	1	0	0	0	0	2	2	0	2
CO3	3	3	0	0	0	1	1	0	0	0	0	3	2	0	2
CO4	3	2		0	0	1	2	0	0	0	0	3	2	0	2

SUBJECT CODE: 21UEC506E	Digital System Design using Verilog	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction to Verilog: Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays,

UNIT–II	10 Hrs.

Introduction to Verilog cont.: Loops in Verilog, Testing a Verilog Model.

Design Examples: Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and De-bouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.

UNIT–III	10 Hrs.

Additional Topics in Verilog: Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks.

Hardware Testing and Design for Testability: Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.

UNIT–IV	10 Hrs.

Component Test and Verification: Test-bench, Combinational circuit testing, Sequential circuit testing, Test-bench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive test-bench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates

Reference Books *

1. Charles Roth, Lizy Kurian John, and ByeongKil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016
2. ZainalabedinNavabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed,2008
3. Palnitkar, Samir. “Verilog HDL: a guide to digital design and synthesis” Vol. 1. Prentice Hall Professional,2003.
4. Sagdeo, Vivek. “The complete Verilog book”. Springer Science & Business Media,2007.
5. Smith, Douglas J., and Alex Foreword By-Zamfirescu. “HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog” Doone Publications,1998.
6. Bhasker, Jayaram. “A Verilog HDL Primer”. Star Galaxy Publishing,1999.

Course Outcomes**

After completion of the course student will be able to write

1. **Verilog code for combinational and sequential circuits.**
2. **Verilog code for a simple digital system for given specifications using different design styles.**
3. **Verilog code using advanced Verilog Concepts.**
4. **Develop Test benches to automate simulation and verification of design.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO2	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO3	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO4	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0

SUBJECT CODE: 21UEC507E	Mobile Communications	Credits: 02
L:T:P - N_L :02 N_T:00 N_P:00		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

UNIT-I	07 Hrs.
Wireless standard organizations. Wireless transmission : Frcquencies for radio communication, signals, antennas, signal propagation. Medium access control: Motivation for specialized MAC, SOMA, FDMA, TOMA, CDMA.	
UNIT–II	**07 Hrs.**
Telecommunication systems: GSM, UMTS and IMT2000, 4GLTE networks, 5G networks over view . Broadcast system: Overview, cyclical repetition of data, digital audio broadcasting, and digital video broadcasting.	
UNIT–III	**07 Hrs.**
Wireless LAN: IEEE802.11 system architecture, protocol architecture, physical layer, medium access controller, MAC management. 802.11b. and 802.11a. Bluetooth: user scenarios, architecture, radio layer.	
UNIT–IV	**07Hrs.**
Mobile network layer dynamic host configuration protocol, mobile Ad-hoc network. Mobile transport layer: Traditional TCP , classical TCP improvement, TCP over2.5/3G wireless network, performance enhancing proxies.	

Reference Books *

1. Jochen Schiller, 2003 "MobileCommunications", second edition PearsonEducation.
2. Gary Mullett, 2006 “Introduction to wireless telecommunication systems and networks ", First Edition Cengage learning

Course Outcomes**

After completion of the course student will be able to

1. identify the different mobile accessing techniques.
2. Identify the different architecture of mobile communications
3. Design and develop the different configurations of LAN systems.
4. Develop different network layer and transport layer protocols.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	2	-	3	-	-	**1**	-	**1**	-	**1**	**1**	**0**	**3**
CO2	2	-	2	-	3	-	-	**1**	-	**1**	-	**1**	**1**	**0**	**3**
CO3	2	-	3	-	2	-	-	**1**	-	**1**	-	**1**	**1**	**0**	**3**
CO4	2	-	3	-	3	-	-	**1**	-	**1**	-	**1**	**1**	**0**	**3**

SUBJECT CODE: 21UEC535N	Communication Systems	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

Introduction to Communication Systems: Elements of Communication Systems, Need for Modulation, Electromagnetic Spectrum and typical applications, Terminologies in communication systems.

Amplitude Modulation Techniques: Elements of analog communication, Theory of amplitude modulation techniques, Generation of amplitude modulated signals.

UNIT–II	xx Hrs.

Angle Modulation Techniques: Theory of angle modulation techniques, Frequency modulation, Practical issues in frequency modulation, Comparison of FM and AM, Generation of frequency modulation: Transistor reactance modulator, Varactor diode modulator, Stabilized reactance modulator-AFC.

Pulse Modulation Techniques: Introduction, Pulse analog modulation techniques, Pulse digital modulation techniques

UNIT–III	xx Hrs.

Digital Modulation Techniques: Introduction, Basic digital modulation schemes, M-ary digital modulation techniques.

Radio Transmitters and Receivers: Introduction to radio communication, Radio transmitters: AM Transmitters, SSB Transmitters, FM Transmitters, Superheterodyne receiver, Single and Independent Side Band Receivers, Slope detection, stereo FM multiplex reception

UNIT–IV	xx Hrs.

Broadband Communication Systems: Multiplexing, Short and medium haul systems, Long haul systems.

Introduction to Fiber Optic Technology: History of fiber optics, introduction to light, The Optical fiber and fiber cables, Fiber optic components and systems.

Reference Books *

1. George Kennedy, Bernard Davis, S R M Prasanna, “Electronic Communication Systems”, Tata McGraw Hill Education Private Limited, New Delhi, 5th Edition
2. B. P. Lathi, Zhi Ding, “Modern Digital and Analog Communication Systems”, Oxford University Press, 4th Edition, 2010
3. Simon Haykin, “Digital communications”, John Wiley, 2014

Course Outcomes**

After completion of the course student will be able to

1. Understand and analyze communication systems and amplitude modulation techniques.
2. Visualize angle and pulse modulation systems.

3. Explain different digital communication systems and radio transmitters/receivers.
4. Categorize broadband and optical fiber communication systems.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO2	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO3	3	3	1	0	1	1	1	0	0	0	0	0	3	0	0
CO4	2	2	1	0	1	1	2	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC532N	Digital Electronics and Microcontrollers	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.
Combinational Logic Circuits: Definition of combinational circuit, design procedure, half adder, full adder, half subtractor, full subtractor, parallel adder, decoder, encoder, comparator (1& 2 bit), multiplexer, demultiplexer.	
UNIT–II	**xx Hrs.**
Microprocessors and Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, Z80 and 8051, 4-bit to 32-bit microcontrollers. 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, basics of input output port	
UNIT–III	**xx Hrs.**
8051 Instructions and Programming: addressing modes, types of instructions, instruction set, and data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, programs using all the above instructions and concepts.	
UNIT–IV	**xx Hrs.**
Programming peripherals in assembly: Timer and counter programming (mode 1). Serial Port Programming: Basics of serial communication, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts.	

Reference Books *

1. Donald D Givone, “Digital principle and design”, Tata McGraw Hill edition, 2002
2. Kenneth J. Ayala, “The 8051 Micro controller Architecture, Programming & Applications”, Penram International, 2nd Edition,1996
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, “The 8051 Micro controller and Embedded Systems”, Pearsons Education, 2nd edition, 2007. John M Yarbrough, “Digital logic applications and design”, Thomson learning, 2001.
4. Thomas L. Floyd, “Digital fundamentals”, 9th edition, PHI.
5. Dr.Uma Rao and Dr. Andhe Pallavi, “The 8051 microcontroller architecture, programming and applications”, Pearson Education, 2010.
6. David Calcutt, Fred cwon, “8051 microcontroller”, Elsevier, 1st Edition, 2004.

Course Outcomes**

After completion of the course student will be able to

1. Proficient in defining, classifying, and analyzing combinational circuits and demonstrate the ability to design and implement various basic combinational circuits effectively.
2. Acquire a comprehensive understanding of microprocessors and microcontrollers and capable of analyzing the architecture and general features of the 8051 microcontroller, including its programming model, pin description, oscillator, clock, registers, and memory organization.
3. Develop programming skills in writing assembly programs that involve data manipulation, arithmetic operations, logical functions, jump, call instructions, and bit- addressable instructions.
4. Gain expertise in programming timers and counters for timekeeping and event counting, serial port communication, enabling data transmission and reception in various applications and handling interrupts for event-driven programming.

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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**2**	**1**		**1**	**1**	**1**							**3**	
CO2	**3**	**2**	**1**		**1**	**1**	**1**							**3**	
CO3	**3**	**2**	**2**		**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**		**3**	
CO4	**3**	**2**	**2**		**2**	**1**	**1**	**2**	**1**	**1**	**1**	**2**		**3**	

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VII
Internship

Course Code:	21UEC510I	CIE Marks	70
Teaching Hours/Week (L:T:P)	--	SEE Marks	30
Credits	02	Hours	30 Min/Student

I. Internship:

Students need to meet following criteria to successfully complete the internship course.

II. Course objectives:

This objective of the course are to

- Enhance student's knowledge of a particular area(s) of Electronics and Communication Engineering.
- Experience integration of theory and practice existing in IT Industries.
- Develop systematic work culture and skills necessary for successful professional career.
- Build the abilities such as working in diverse areas, self learning, lifelong learning and technical documentation and reporting.

III. Components of Internship

1. Student's Diary/ Daily Log

Student's Diary and Internship Report should be submitted by the students along with attendance record andan evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completionof the training. It will be evaluated based on the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches, and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

2. Internship Report

The Internship report will be evaluated based on following criteria:

- Originality.
- Internship certificate from the industry.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course

IV. Course outcomes:

After completion of the course the student will be able to:

1. Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation.
2. Solve simple real time problems associated in their field of internship.
3. Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.
4. Document and present technical matter to fellow colleagues effortlessly.

V. Evaluation:

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation through seminar presentation
3. Viva-voce at the Institute.

Evaluation Through Seminar Presentation/Viva-Voce at The Institute

The student has to give a seminar based on his/her training, before an expert committee constituted by theconcerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analysed along with theInternship Report

Evaluation Criteria

Summary of Internship Evaluation	
Guide at the Industry	
Evaluation Criteria	**Marks**
Quality of Work	10
Ability to Learn	10
Initiative and Creativity	10
Character Traits	10
Dependability	10
Organizational Fit	10
Response to Supervision	10
Total (A)	**70**
Department Committee(Faculty Advisor+External+HoD/Nominee)	

Demonstration of experience	10
Report	10
Presentation	10
Total (B)	**30**
Total Score (A+B)	**100**

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) andProgramme Specific Outcomes (PSO)

No	Programme Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
The students will be able to:																
1	Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
2	Solve simple real time problems associated in their field of internship.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
3	Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**
4	Document and present technical matter to fellow colleagues effortlessly.	3	**2**	**2**	**2**	**3**	**3**	3	1	3	**3**	3	3	**1**	**1**	**1**

Evaluation of Internship – Grading Rubrics for Industry

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement	Meets Expectations	Excellent	
	0-4	5-7	8-10	
Internship Evaluation Dimensions – Grading Criteria				
Quality of Work	Work was done in a careless manner and was of erratic quality; Work assignments were usually late and required review; Made numerous errors	With a few minor exceptions, adequately performed most work requirements; Most work assignments submitted in a timely manner; Made occasional errors	Thoroughly and accurately performed all work requirements; Submitted all work assignments on time; Made few if any errors	10
Ability to Learn	Asked few questions and rarely sought out additional information Unable or slow to understand new concepts, ideas, and work assignments; Unable or unwilling to recognize mistakes and was not receptive to making needed changes and improvements	Asked relevant questions and sought out additional information from appropriate sources; Acceptable understanding of new concepts, ideas, and work assignments; Willing to take responsibility for mistakes and to make needed changes and improvements	Consistently asked relevant questions and sought out additional information from appropriate sources; Quickly understood new concepts, ideas, and work assignments; Always willing to take responsibility for mistakes and to make needed changes and improvements	10

Initiative and Creativity	Had little observable drive and required close supervision; Showed little interest in meeting standards; Did not seek out additional work and frequently procrastinated in completing assignments; suggested no new ideas or options	Worked without extensive supervision; Found problems to solve and sometimes asked for additional work assignments; Set his/her own goals and, tried to exceed requirements; offered some creative ideas	A self-starter; Consistently sought new challenges and asked for additional work assignments; Regularly approached and solved problems independently; Frequently proposed innovative and creative ideas, solutions, and/or options	10
Character Traits	Regularly exhibited a negative attitude; Dishonest and/or showed a lack of integrity on several occasions; Unable to recognize and/or was insensitive to ethical and diversity issues; Displayed significant lapses in ethical and professional behavior	Except in a few minor instances, demonstrated a positive attitude; Regularly exhibited honesty and integrity in the workplace; Usually aware of and sensitive to ethical and diversity issues on the job; Normally behaved in an ethical and professional manner	Exceptionally positive attitude; Consistently exhibited honesty and integrity in the workplace; Keenly aware of and deeply sensitive to ethical and diversity issues on the job; Always behaved in an ethical and professional manner	10

Evaluation Dimensions	**Performance Rating**			**Maximum Score**
	Needs Improvement	**Meets Expectations**	**Excellent**	
	0-4	**5-7**	**8-10**	
Internship Evaluation Dimensions – Grading Criteria				
Dependability	Generally unreliable in completing work assignments; Did not follow instructions and procedures promptly or accurately; Careless, and work needed constant follow-up; required close supervision	Generally reliable in completing tasks; Normally followed instructions and procedures; Usually attentive to detail, but work had to be reviewed occasionally; Functioned with only moderate supervision	Consistently reliable in completing work assignments; Always followed instructions and procedures well; Careful and extremely attentive to detail; Required little or minimum supervision	10

Organizational Fit	Unwilling or unable to understand and support the organization's mission, vision, and goals; Exhibited difficulty in adapting to organizational norms, expectations, and culture; Frequently seemed to disregard appropriate authority and decision-making channels	Adequately understood and supported the organization‟s mission, vision, and goals; Satisfactorily adapted to organizational norms, expectations, and culture; Generally functioned within appropriate authority and decision-making channels	Completely understood and fully supported the organization‟s mission, vision, and goals; Readily and successfully adapted to organizational norms, expectations, and culture; Consistently functioned within appropriate authority and decision-making channels	10
Response to Supervision	Rarely sought supervision when necessary; Unwilling to accept constructive criticism and advice; Seldom implemented supervisor suggestions; Unwilling to explore personal strengths and areas for improvement	Sought supervision when necessary; Receptive to constructive criticism and advice; Implemented supervisor suggestions in most cases; Willing to explore personal strengths and areas for improvement	Actively sought supervision when necessary; Always receptive to constructive criticism and advice; Successfully implemented supervisor suggestions when offered; Always willing to explore personal strengths and areas for improvement	10

Evaluation of Internship – Grading Rubric for Department Evaluation Committee/Faculty				
Evaluation Dimensions	**Performance Rating**			Maximum **Score**
	Needs Improvement	**Meets Expectations**	**Excellent**	50
	0-4	**5-7**	**8-10**	
Internship Evaluation Dimensions – Grading Criteria				
Demonstration of experience	Offers little in the way of illustrating experiences Fails to adequately address how the experiences relate to the competencies.	Addresses the activities and experiences, but not so clearly and concisely	Well addressed activities and experiences as well as relating them to the program competencies.	10

Report	Unedited and difficult to read It is littered with grammatical and typographical errors, demonstrating little effort to producing a quality report. No reference is made to practical application. Lacks evidence and internship experience	Well-written for the most part but still has somewhat detracting errors that could have been fixed with additional editing prior to submission. Key conceptsrelated to the selected evidence and internship experience are inaccurate o r incomplete. Some helpfu l practical applications are included.	Has been carefully edited and is free or nearly free of any grammatical or typographical errors. Well-organized report is easy to read and understand and stands alone as a quality piece of writing. An accurate and complete reflection of key concepts related to the selected evidence and internship experience Practical applications are included to illuminate issues.	10
Presentation	Information is lacking/unclear and communicated in such a way that the audience cannot understand the purpose of the evidence work and internship experiences.	Information is presented in a clear manner but still lacks practical experience	Information is communicated in a thorough manner and ideas are expressed in such a way that the audience can clearly understand the evidence work and internship experiences.	10

SUBJECT CODE: 21UBT521C/21UBT621C	Environmental Studies	Credits: 01
L:T:P – 1-0-0		CIE Marks: 50
Total Hours/Week: 01		SEE Marks: 50

UNIT-I	04 Hrs.

Natural Resources: 04 Hours

Human activities and their impacts. **Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel. **Non renewable Energy**: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT–II	04 Hrs.

Environmental Pollution:

Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves.

Sustainable future:

Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, clean development mechanism (CDM).

UNIT–III	03 Hrs.

Current Environmental Issues of concern: 03 hours Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication, Environmental policy legislation rules & regulations

UNIT–IV	04 Hrs..

Fundamentals of Waste management: 04 hours Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment, Bioremediation, Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).

Reference Books *

1. Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005
2. Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006
3. Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006
4. Meenakshi "Environmental Science & Engineering" Pranticce Hall of India, 2006

Course Outcomes**

After completion of the course student will be able to

1. **Ability to recognize natural resources and its uses.**
2. **Able to understand pollution and its effects on environment and to implement sustainable future in the work place.**
3. **Ability to understand current environmental issues.**
4. **Able to apply the waste management techniques in various fields**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO3	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO4	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**		**-**	**3**	**1**	**-**	**1**

SUBJECT CODE: 21UHS521C	Quantitative Aptitude and Professional Skills	**Credit: 02**
L:T:P - 2 : 0: 0		CIE Marks: 50
Total Hours/Week:02		SEE Marks: 50

Course Objectives:

1. To develop and augment written English language vocabulary and comprehension skills
2. To augment the ability to understand and analyse a problem and find its solution through analysis of data given
3. To fine-tune the quantitative analysis and problem-solving skills

UNIT-I	**08 Hrs.**
Vocabulary Development: Vocabulary Building Techniques, Root Words, Antonyms & Synonyms, Sentence Completion, Error Detection & Correction, Reading Comprehension	
UNIT–II	**08 Hrs.**
Numbers, Proportion & Finance: Number System, Factors & Multiples, The God of Math – Linear Equations, Ratio-Proportion-Variation, Percentages, Profit & Loss, Interest, Averages & Alligations	
UNIT–III	**07 Hrs.**
Time & Probability: Time & Work, Time Speed, & Distance, Permutations & Combinations, Probabilit	
UNIT–IV	**07 Hrs.**
Verbal, Analytical, and Visual Reasoning: Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning, Analytical Puzzles, Mathematical, Arrangement & Classification Puzzles	
Reference Books	
1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018 2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018	

3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House, 1989
6. Shakuntala Devi , “Puzzles to Puzzle You”, Orient Paper Backs, New Delhi, 1976
7. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, Sultan Chand and Sons, New Delhi, 2018
8. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
9. Kaplan’s GRE guide

Course Outcomes

Course Outcomes:

After active participation in this course, the student will have

CO1: Enhanced his/her vocabulary and learnt techniques to augment it further

CO2: Learned the techniques to augment his/her verbal ability

CO3: Understood step-by-analysis of the given problem and learnt to develop a method for solving it

CO4: Enhanced and augmented his/her ability to work with quantitative problems

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1							2	3		1		
CO2		1							2	3				
CO3		2	2	3								1		
CO4		1		2							2	1		

VI Semester Syllabus

SUBJECT CODE: 21UEC601C	Information Theory and Coding	Credits: 03
L:T:P - 3 :0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Information theory: Introduction, measure of information, average information content of symbols in long independent sequences, average information content of symbols in long dependent sequences, Markov statistical model for information source, entropy and information rate of Markov source.

Source Coding: Properties, Shannon's encoding algorithm, Shannon-Fano encoding algorithm, Huffman Coding.

UNIT–II	10 Hrs.

Communication channels: Discrete communication channels, entropy functions and equivocation, mutual information, properties of mutual information, rate of information transmission over a discrete channel, capacity of a discrete memory less channel, Shannon's theorem on channel capacity, channel efficiency and redundancy, symmetric/uniform channel, binary symmetric channel, binary erasure channel. Shannon-Hartley law and its implications.

UNIT–III	10 Hrs.

Error control coding: Introduction, types of errors, examples of error control coding, methods for controlling errors, types of codes. **Linear Block Codes:** Matrix description of LBC, encoding circuit for (n, k) linear block codes, syndrome and error correction, syndrome calculation circuit, Hamming weight, Hamming distance and minimum distance of LBC, error detection and correction capability of LBCs, standard array.

UNIT–IV	10 Hrs.

Binary Cyclic Codes: Algebraic structure of cyclic codes, encoding using (n, k) bit shift register, syndrome calculation, error detection and correction.

Convolution codes: Connection pictorial representation, time and transform domain approach, systematic convolution codes, **Structural properties of convolution codes:** State diagram, code tree, trellis diagram.

Reference Books *

1. P.S. Satyanarayana,2004, Concepts of information theory and coding (2nd edition)Dynaram**.**
2. Bernard Sklar,2002, Digital communication fundamentals and applications (2nd edition) Pearson education.
3. K. Sam Shanmugam, 1996, Digital and analog communication systems**,** John Wiley.
4. Simon Haykin,2003, Digital communication**,**John Wiley.

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate the basic information theory concepts, entropy, need of coding and working of different types of source coding techniques.

2. Derive channel capacity expression for different types of discrete communication channels and describe entropy functions, equivocation, mutual information of communication channel.
3. Design an encoder, decoder, and error correction circuit for linear block code.
4. Design an encoder, decoder and error correction circuit for cyclic code and demonstrate encoding of convolutional codes, also verify its structural properties using code tree and trellis diagram.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

****** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	0	1	1	1	0	0	0	0	0	3	0	0
CO2	3	2	1	0	0	1	0	0	0	0	0	0	3	0	0
CO3	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0
CO4	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC602C	Electromagnetic Theory	Credits: 03
L:T:P - 2 : 2 : 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	10 Hrs.

Coulomb's Law and electric field intensity: Introduction to coulomb's law, field intensity,field due to continuous volume charge distribution, Field of a line charge & field of sheet charge, Electric flux density Gauss law and divergence: Electric flux density, Gauss law, Application of Gauss law for symmetrical charge distribution (point charge, Coaxial cable)and differential volume element, Divergence, Maxwell's first equation, vector operator delland divergence theorem.

UNIT–II	10 Hrs.

Energy and potential: Energy expended in moving a point charge in an electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, potential field of system of charges, potential gradient, Energy density in an Electrostatic Field.

Conductors, dielectrics and capacitance: Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples (Parallel plate capacitor, Dielectric boundary normal to plates).

UNIT–III	10 Hrs.

Poisson's and Laplace's equations: Poisson's and Laplace's equations. Uniqueness theorem,examples of the solution of Lapalce and poisson's equations.

Thesteddy Magnetic Field:Biot-savart's law,Ampere's Circuital Law,curl,stokes theorem, magnetic flux density, scalar and vector magnetic potentials.

UNIT–IV	10 Hrs.

TimevaryingfieldsandMaxwell'sequations:Faraday's Law,Displacement Current,Maxwell's equation in point and integral form, retarded potentials.

Uniform Plane Wave:Wave Propagation Infreespacean Dielectrics,Poynting's Theorem and wave power, Planewaveinboundariesandindispersivemedia:Reflection Uniform Plane Wave At normal incidence, SWR.

Reference Books *

1. WilliamHHaytJr,JohnABuck,"EngineeringElectronics",TataMcGraw-Hill,7th edition, 2006
2. JohnKraussandDanielAFleisch,"Electromangeticswithapplication",McGraw- Hill, 5th edition, 1999
3. DavidKCheng,"FiledandwaveElectromangetics"PearsoneducationAsia,2nd edition,-1989, Indian Reprint-2001.

Course Outcomes**

After completion of the course student will be able to

1. Understand the concept of scalar, vectors, Coulombs law, Electric filed intensity,Gauss law and its applications, divergence and analyze the problems based on the mentioned laws
2. Understand potential due to charges, potential gradient, continuity equation, boundary

conditions and capacitance and Analyze the problems based on the mentioned laws

3. Understand Poisson's, Laplaces equation and its application, Uniqueness theorem, Biot-savart's law, ampere's law, stokes theorem and Curl with respect to magnetic fields and analyze the problems related to the mentioned laws
4. Understand about time varying fields, Maxwell's equation, retarded potential, wave propagation in free space, Poynting's theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR) and analyze the problems based on the mentioned laws.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	2	2	2	1	0	0	0	0	3	0	0
CO2	3	2	3	2	1	2	2	1	0	0	0	0	3	0	0
CO3	3	2	3	2	2	2	2	1	0	0	0	0	3	0	0
CO4	3	3	3	3	3	3	3	1	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC603C	Computer Networks	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Layered Tasks,OSIModel,LayersinOSImodel,TCP/IPSuite,Addressing,DataLinkControl: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC, PPP.	
UNIT–II	**10 Hrs.**
MultipleAccesses:Randomaccess,Controlledaccess,Channelization,WiredLAN,Ethernet,IEEE standards,StandardEthernet.Changesinthestandards,FastEthernet,GigabitEthernet,Connecting LANs,BackboneandVirtualLANs	
UNIT–III	**10 Hrs.**
NetworkLayer,Logicaladdressing,Ipv4addresses,Ipv6addresses,Ipv4andIpv6Transitionfrom Ipv4 to Ipv6, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols.	
UNIT–IV	**10 Hrs.**
Transport layer Process to process Delivery, UDP, TCP, Application Layer: Domain name system,NameSpace,DomainNameSpace,DistributionofNameSpace,DNSintheInternet,Resolution, DNS messages, Types of Records, Registrars, Dynamic Domain Name System, Encapsulation.	

Reference Books *

1. DataCommunicationandNetworking,"BehrouzA.Forouzan",4th Edition,TMH,India,2006.
2. AndrewS.Tanenbaum,"Computer Networks",Prentice-Hall,2010.
3. WilliamStallings,"DataandComputerCommunications",Prentice-Hall,2007.

Course Outcomes**

After completion of the course student will be able to

1. Master the terminology and concepts of the OSI reference model and the TCP/IP reference model
2. Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks
3. Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.
4. Become familiar with Widely-used Internet protocols lichas TCP/IP,UDP,etc.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

SUBJECT CODE: 21UEC604L	Computer Networks Laboratory	Credits: 01
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

Sl.No.	LISTOF EXPERIMENTS
1.	Study of different types of network cables and practically implement the cross-wiredcableandstraightthroughcableusing clampingtool
2.	Study of network components/devices:i)NICii)Hubiii)Switch
3.	Connecting computers on LocalAreaNetwork(LAN)
4.	Study of packet tracer
5.	Configuration of different network topologies using packet tracer
6.	ConfigurationofswitchandestablishingLANusingpackettracer
7.	CreationofVirtualLAN(VLAN)usingpackettracer
8.	Configuration Of Basic Routing Using Packet Tracer
9.	ConfigurationofanetworkusingRoutingInformationProtocol(RIP)using packet tracer
10.	ConfigurationofanetworkusingOpenShortestpathFirst(OSPF)using packet tracer
11.	ConfigurationofDHCPusing packet tracer
12.	ConfigurationofNATusingCISCOpackettracer

Course Outcomes**

After completion of the course student will be able to

1. To Apply theconceptsofDataCommunicationandNetworking
2. TodoInternetworking&devices
3. To Develop New Routing techniques
4. Practically Know The Functionality ofdevicesusingRIP,OSPF,DHCP,andNAT

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

SUBJECT CODE: **21UEC605L**	**Advanced Communication Laboratory**	**Credits: 01**
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

Sl.No.	**LIST OF EXPERIMENTS**
1.	Verification Of The Sampling Theorem
2.	Generation and detection of ASK signal
3.	Generation and detection of FSK signal
4.	GenerationanddetectionofPSKsignal
5.	Study ofradiationpatternofDIPOLEantenna
6.	StudyofradiationpatternofHORNantenna
7.	StudyofradiationpatternofYAGI-UDAantenna
8.	Measurementoffrequencyandwavelengthofamicrowavesource
9.	Study themodecharacteristicsofReflexklystron
10.	Measurement of coupling factor, insertion loss and directivity of a Directional Coupler
11.	StudyofMagicTeeanditscharacteristics
12.	StudyofV-IcharacteristicsofGunndiodeandGunndiodeasanoscillator
13.	ToStudythecharacteristicsoflowpassandhighpassmicrostripfilter
14.	ToStudythecharacteristicsofbandpassandbandstopmicrostripfilters
15.	Tostudythecharacteristicsofringresonatorinmicrostrip
16.	Tostudyandplottheradiationpatternofmicrostrippatchantenna

Course Outcomes**

After completion of the course student will be able to

1. Designandtestthedigitalmodulationtechniquesandanalyzethewaveforms

2.	Determine The Radiation Pattern Of Different Antennas
3.	Determinethecharacteristicsandresponseofmicrowavedevices
4.	Determine the characteristics of micro strip antennas and devices and compute the parameters associated with it

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO2	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO3	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO4	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0

SUBJECT CODE: 21UEC606E	Biomedical Signal Processing	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction to Biomedical Signal: The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis.

Neurological Signal processing: Brain and its potentials, Electrophysiological origin ofBrain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Autoregressive (AR)method,Recursive Estimation of AR parameters,Spectral error measure, Adaptive segmentation.

UNIT–II	10 Hrs.

Filtering for Removal of Artifacts: Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, Time domain filters with application: Synchronized averaging, moving-average filters. Frequency domain filters with examples: removal of high frequency noise by Butterworth low pass filters, removal of low frequency noise by Butterworth high pass filter, removal of periodic artifacts by notch and comb filters. Optimal filtering: Weiner filter.

UNIT–III	10 Hrs.

Signal Averaging: Basics of signal averaging, Signal averaging as a digital filter, A typical average, Software for signal averaging, Limitations of signal averaging.

DataAcquisitionandclassificationofsleepstages,TheMarkovmodelandMarkovchains,DynamicsofSleep-wakeTransitions,HypnogramModelParameters.

CardiologicalSignalProcessing:ECGParametersandtheirestimation

UNIT–IV	10 Hrs.

Adaptive Interference/Noise Cancellation: A review of wiener filtering problem, Principle Of an adaptive filter, the steepest descent algorithm, Adaptive noise canceller, Cancellation of 60Hz Interference in ECG, Canceling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles, Canceling of maternal ECG in Fetal ECG, Cancellation of higher frequency noise in electro- surgery.

ECG Data Reduction Techniques: Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.

Reference Books *

1. Rangaraj M Rangayyan,“Biomedical signal analysis- A case- study approach”, Wiley 2009.
2. D. C. Reddy, “Biomedical Signal Processing- Principles and Techniques”, Tata McGraw Hill, 2008.
3. WillisJ.Tompkins,“BiomedicalDigitalSignalProcessing”,PHI,2006.
4. AkayM,"BiomedicalSignalProcessing",Academic:Press1994.

Course Outcomes**

After completion of the course student will be able to

1. Analyze the nature of Biomedical signals and related concepts.

2. Apply filters to remove noise from biomedical signals.
3. Apply averaging technique on biomedical signals and extract the features of EEG and ECG signals. Also analyze event detection techniques for EEG and ECG signals.
4. Applydifferentfiltersfornoisecancellationandsignalcompressiontechniqueson biomedical signals.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	3	3	2	1	1	1	1	2	3	0	0
CO2	3	3	3	3	3	3	1	0	0	0	0	2	3	0	0
CO3	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0
CO4	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0

SUBJECT CODE: 21UEC607E	Computer Organization	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts,BusStructures,Performance–ProcessorClock,BasicPerformanceEquation, Clock Rate, Performance Measurement, Historical Perspective.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location andAddresses, Memory Operations, Instructions and Instruction Sequencing. Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.

UNIT–II	10 Hrs.

Input/Output Organization: Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interrupts – Interrupt Hardware, Enabling and DisablingInterrupts,Handling InterfaceCircuits,StandardI/OInterfaces–PCIBusand USB.

UNIT–III	10 Hrs.

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size and Cost, Cache Memories–Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage. **Arithmetic:** Addition And Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers

UNIT–IV	10 Hrs.

Arithmetic Cont.: Signed, Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.

Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Microprogrammed Control.

Reference Books *

1) Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, Tata McGraw Hill, 5th Edition, 2002
2) David A. Patterson, John L. Hennessy, “Computer Organization and Design – The Hardware /Software Interface ARM Edition”, Elsevier, 4th Edition, 2009
3) WilliamStallings,“ComputerOrganization&Architecture”,PHI,7thEdition,2006

Course Outcomes**

After completion of the course student will be able to

1. Have thorough knowledge about structure and performance of a modern digital computer.
2. Analyze the different ways of communicating with I/O devices and standard I/O interfaces in

a compute including using interrupt.

3. Analyze memory hierarchy including main memory, cache memory, virtual memory and secondary memory considering cost/performance.Different Mapping Functions of cache.
4. Implement arithmetic operations like multiplication, division and analyze the processofinstructionexecutionofacompleteinstructionintheprocessing unit and its control.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO2	1	1	2	1	3	0	0	0	0	0	0	0	0	0	3
CO3	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO4	1	1	3	1	3	0	0	0	0	0	0	0	0	0	3

SUBJECT CODE: 21UEC608E	Digital Image Processing (Department Elective)	Credits: 03
L:T:P - 3: 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course Objectives:

1. To provide the basic knowledge on image processing concepts.
2. To develop the ability to apprehend and implement various image processing algorithms.
3. To understand various image processing steps and their applications in real time
4. To facilitate the students to comprehend the contextual need pertaining to various image processing applications.

UNIT-I	10 Hrs.

Introduction- Digital Image, its Representation & point operations: Image Representation and Image Processing Paradigm - Elements of digital image processing, Image model. Sampling and quantization-Relationships between pixels- Connectivity, Distance Measures between pixels, Color image (overview, various color models)-Various image formats bmp, jpeg, tiff, png, gif, etc. Noise in Images Sources, types. Arithmetic operations, Logical operations, Spatial operations Single pixel, neighbour hood, geometric-Contrast Stretching-Intensity slicing-Bit plane slicing Power Law transforms.

UNIT–II	xx Hrs.

Image Enhancement: Spatial and Frequency domain-Histogram processing-Spatial filtering-Smoothening spatial filters, Sharpening spatial filters; Frequency filtering-Smoothening frequency filters-Sharpening frequency filters, Selective filtering.

Image Restoration: Noise models - Degradation models-Methods to estimate the degradation-Image deblurring Restoration in the presence of noise only spatial filtering-Periodic noise reduction by frequency domain filtering-Inverse filtering-Wiener Filtering.

UNIT–III	xx Hrs.

Feature Extraction: Region of interest (ROI) selection - Feature extraction: Histogram based features - Intensity features-Color, Shape features-Contour extraction and representation-Homogenous region extraction and representation-Texture descriptors.

Image Segmentation: Discontinuity detection-Edge linking and boundary detection. Thresholding-Region oriented segmentation- Histogram based segmentation. Object recognition based on shape descriptors.

UNIT–IV	xx Hrs.

Image Coding and Compression: Lossless compression versus lossy compression-Measures of the

compression efficiency- Huffmann coding, Bit plane coding, Arithmetic coding.

Wavelet Transform in image processing: Wavelet Transform in one dimensions, Wavelet transforms in two dimensions. Fast Wavelet Transform , Other Applications of Wavelet in image processing.

Reference Books *

Author/s last Name, initial (Year), Book Title (edition), Publisher

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018. 2. William 2. K. Pratt, Digital Image Processing, 4th Edition, John Wiley, 2007.
3. Fundamentals of Digital Image Processing, Jain A.K., PHI, 1997
4. Insight into wavelets - From theory to practice, K. P. Soman and K. I. Ramchandran, PHI ,2005, Second Edition.
5. Rafael C. Gonzalez, "Digital Image processing using MATLAB", Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.

Course Outcomes**

After completion of the course student will be able to

1. Ascertain and describe the basics of image processing concepts through mathematical interpretation and operations.
2. Acquire the knowledge of various image enhancement techniques involved.
3. Demonstrate image restoration process and its respective filters required.
4. Experiment the various image segmentation and feature extraction operations.
5. Design the various image coding and compression procedures and illustrate the wavelet transform in images with its applications.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO2	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO3	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO4	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0
CO5	3	3	3	2	2	1	0	1	1	1	0	1	3	0	0

Assignment:

Students are required to develop programs using Matlab.

List of Programs

1. Write program to read and display digital image using MATLAB or SCILAB
    a. Become familiar with SCILAB/MATLAB Basic commands
    b. Read and display image in SCILAB/MATLAB
    c. Resize given image
    d. Convert given colour image into gray-scale image
    e. Convert given colour/gray-scale image into black & white image
    f. Draw image profile
    g. Separate colour image in three R G & B planes
    h. Create colour image using R, G and B three separate planes
    i. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
    a. Obtain Negative image
    b. Obtain Flip image
    c. Thresholding
    d. Contrast stretching
3. To write and execute programs for image arithmetic operations
    a. Addition of two images
    b. Subtract one image from other image
    c. Calculate mean value of image
    d. Different Brightness by changing mean value

4. To write and execute programs for image logical operations
    a. AND operation between two images
    b. OR operation between two images
    c. Calculate intersection of two images
    d. Water Marking using EX-OR operation
    e. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
    a. Standard MATLAB function
    b. Program without using standard MATLAB functions
6. To write and execute program for geometric transformation of image
    a. Translation b. Scaling c. Rotation d. Shrinking e. Zooming
7. To understand various image noise models and to write programs for
    a. image restoration b. Remove Salt and Pepper Noise c. Minimize Gaussian noise d. Median filter and Weiner filter
8. Write a program in MATLAB/SCILAB for edge detection using different edge detection mask
9. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

SUBJECT CODE: 21UEC614E	Embedded System	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to embedded systems, embedded system vs. general computing system, classifications, purpose of embedded system, major application areas including some novel applications. The typical embedded system: Core of embedded system, memory, sensors and actuators, communication interface, Characteristics and quality attributes of embedded systems.	
UNIT–II	**10 Hrs.**
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, architecture of ARM Cortex M3, various units in the architecture, debugging support, general purpose registers, special registers, exceptions, interrupts, stack operation, reset sequence.	
UNIT–III	**10 Hrs.**
Hardware software co-design and program modeling: fundamental issues in hardware software co-design, computational models in embedded system, hardware software trade-offs. Embedded firmware design and development: design approaches, Mixing assembly and high level language, Programming in embedded C.	
UNIT–IV	**10 Hrs.**
Real-time operating system based embedded system: operating system basics, need for RTOS, types of operating system, tasks, process and threads, multiprocessing and multitasking, task scheduling, threads, processes and scheduling : putting altogether, task communication, task synchronization, device drivers.	

Reference Books *

1. Shibu K V, "Introduction to embedded systems", Tata McGraw Hill private limited, 2010.
2. Joseph Yiu, "The definitive guide to the ARM CORTEX-M3", Newnes, Second edition.
3. Rajkamal, "Embedded systems: architecture, programming and design", Tata McGraw Hill private limited, second edition.
4. Frank Vahid, Tony Givargis, "Embedded system design: A unified hardware/software introduction", John Wiley and Sons, 2001.

Course Outcomes**

After completion of the course student will be able to

1. Gain comprehensive knowledge about embedded systems, major application area of embedded systems and system components like memory, sensors and actuators.
2. Gain comprehensive knowledge about ARM-32 bit Microcontroller, architecture and other internal details.
3. Develop embedded applications on IDE environment and programming in embedded 'C'.

4. Explore one opensource RTOS and demonstrate the basic concepts of RTOS.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	0	1	1	0	0	0	0	0	0	0	3	0
CO2	3	2	2	0	1	1	0	0	0	0	0	0	0	3	0
CO3	3	3	3	0	3	3	0	0	0	0	0	0	0	3	0
CO4	3	3	3	0	3	2	0	0	0	0	0	0	0	3	0

SUBJECT CODE: 21UEC615E	Wireless Networks	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Wireless networks: Wireless network architectures, classification of wireless networks, wireless switching technology, wireless communication problems, wireless network reference model, wireless networking issues, wireless networking standards. Wireless Body Area Network(WBAN): Properties, network architecture, network components, design issues, network protocols,WBANTechnologies,WBAN Applications. Wireless Personal Area Network(WPAN): Wireless Personal Area Network, network architecture, Piconet and Scatternet, WPAN components, WPAN technologies and protocols, WPAN Applications.	
UNIT–II	**10 Hrs.**
WirelessLocalAreaNetwork(WLAN):Networkcomponents,designrequirementsofWLAN, network architecture, WLAN standards, WLAN protocols, IEEE 802.11p, WLAN Applications	
UNIT–III	**10 Hrs.**
Wireless Metropolitan Area Network (WMAN): Wireless Metropolitan area networks, WMAN network architecture ,network protocols, broadband wireless networks,WMANApplications. Ad-hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.	
UNIT–IV	**10 Hrs.**
MAC Protocols for ad hoc wireless networks: Introduction, issues in designing a MAC protocol for Ad hoc wireless networks, design goals of a MAC protocol for Ad hoc wireless networks, classification of MAC protocols, contention based protocols with reservation mechanisms. Contention-based MACprotocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. Overview of ad hoc routing protocols.	

Reference Books *

1. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks:Concepts and Protocols", Wiley-India, First Edition, 2010
2. C.SivaRamMurthy,B.S.Manoj"AdhocwirelessNetworks",PearsonEducation,2nd Edition, 2005.
3. KavehPahlavan,P.Krishnamurthy,"PrinciplesofWirelessNetworks",Pearson Education, First Edition, 2002
4. Yi-BingLin,ImrichChlamtac,"WirelessandMobileNetworkArchitectures",John Wiley, First Edition, 2001
5. MarlynMallick,"MobileandWirelessDesignEssentials",Wiley,FirstEdition,2003
6. William C. Y. Lee, "Mobile Cellular Telecommunication – Analog and Digital Systems", McGraw Hill, 2ndEdition, 1995

Course Outcomes**

After completion of the course student will be able to

1. Understand Fundamentals Of Wireless Networks
2. Analyzeuniquecharacteristicsandvariousdesignissuesinwirelessnetworks
3. Demonstratebasicskillsfordifferenttypesofwirelessnetworksdesign
4. ApplyknowledgeofvariousTCP/IPprotocolsforwirelessnetworking**.**

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

SUBJECT CODE: 21UEC609N	Sensor Technology	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

Sensor Fundamentals: Introduction, Definition, Types, and Sensor Characteristics
Principles of Sensing: Capacitive, Magnetic, Inductive, Resistive, Piezoelectric, Piezoresistance, Pyroelectric, Hall effect.
Interfacing Electronic Circuits: Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, A to D Converters, Bridge Circuits, Data Transmitters, Batteries for low power sensors

UNIT–II	xx Hrs.

Overview of Sensor Materials: Sensor materials and material properties, Surface Processing of materials for development of Sensors.
Sensor Technologies: Micro technology**,** Micro-Electro-Mechanical Systems Technology, Nanotechnology
Sensor Applications: Displacement Sensing, level & Velocity Sensors, Accelerometers, Tactile Sensors, Pressure Sensors, Temperature Sensors, Comb drive Sensors.

UNIT–III	xx Hrs.

Mechanical and Electromechanical sensor: Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity.
Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature,
Capacitive sensors: Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect
Case Study: Piezoelectric and Capacitive Pressure Sensors, Cantilever based DNA Sensor, CNT based Pressure Sensor.

UNIT–IV	xx Hrs.

Interfacing: Communication Basics, parallel, serial and wireless communication, Basic protocol concept, communication protocols, USB interface, Processor interfacing basics, Controller and computer based control implementations. Introduction to wireless sensor network and wireless network protocols

Reference Books *

1. Jacob Fraden, “Handbook of Modern Sensors: Physical Design & Applications”, AIP Press, Springer.
2. D. Patranabis, “Sensors & Transducers”, PHI Publication New Delhi.
3. Frank Vahid, Tony Givargis, “Embedded system Design”,JohnWieley& Sons, Inc, 2002
4. H.K.P. Neubert, “Instrument transducers”, Oxford University press.

5. E.A. Doebelin, “Measurement systems: application & design”, Mc Graw Hill

Course Outcomes**

After completion of the course student will be able to

1. Use concepts for converting a physical parameter into an electrical quantity
2. Identify appropriate sensor materials and technology while designing sensors
3. Comprehend working principle of mechanical, strain gauge and capacitive sensors.
4. Set up sensor data acquisition and communication strategies
5. Suggest sensor performance improvement methodologies

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**3**	**2**			**2**		**2**				**2**	**3**	**1**	
CO2	**3**	**1**	**2**			**3**			**2**			**3**	**3**	**2**	
CO3	**3**	**3**	**3**		**2**	**2**				**1**		**2**	**3**	**2**	
CO4	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**		**1**	**2**	**3**	**3**	**3**	

SUBJECT CODE: 21UEC610N	Image Processing (Open Elective)	Credits: 03
L:T:P - 3:0:0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course Objectives:

1. To provide the basic knowledge on image processing concepts.
2. To develop the ability to apprehend and implement various image processing algorithms.
3. To understand various image processing steps and their applications in real time.
4. To facilitate the students to comprehend the contextual need pertaining to various image processing

UNIT-I	10 Hrs.

Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; image sensing and acquisition; sampling and quantization; representation of digital images, image interpolation, Basic relationship between pixels; arithmetic and logic operations.

UNIT–II	10 Hrs.

Transformation and spatial filtering: Basics of intensity transformation and functions, Histogram Processing, equalization and histogram matching.Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Restoration: Image Restoration: Image Degradation/Restoration Process, Noise Models.

UNIT–III	10 Hrs.

Restoration in the Presence of Noise Only-Spatial Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Color image processing: fundamentals, color models pseudo colour image processing, colour transformations.

UNIT–IV	10 Hrs.

Image Compression: Fundamentals, Image Compression Models and methods: Huffman coding, Golomb coding, arithmetic coding, LZW coding JPEG, predictive coding. Digital watermarking Applications in satellite, sonar, radar, medical areas and process industries.

Reference Books *

1. R. C. Gonzalez, R. E. Woods, “Digital Image processing”, Addison Wesley/ Pearson education, New Delhi, India, 3rd edition, 2002.
2. A. K. Jain, “Fundamentals of Digital Image processing”, Prentice Hall of India, New Delhi, 2nd Edition, 1997.
3. Rafael C. Gonzalez, “Digital Image processing using MATLAB”, Richard E. Woods and

Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.
4. S. Jayaraman, S. Esakkirajan, T.Veerakumar, "Digital Image Processing", Tata McGraw- Hill Education.

Course Outcomes

After completion of the course student will be able to

1. Articulate the fundamentals of Digital image processing including the simple image formation and relationship between pixels
2. Application of different types of Image transformation techniques, histogram processing and application of spatial filters.
3. Analyze the significance of image restoration and processing of colour images.
4. Illustrate the image compression like lossy and loss less image compression techniques.

Assignment:

Students are required to develop programs using Matlab.
List of programs:

1. Image Printing Program Based on Half toning.
2. Reducing the Number of Intensity Levels in an Image.
3. Zooming and Shrinking Images by Pixel Replication.
4. Zooming and Shrinking Images by Bilinear Interpolation.
5. Arithmetic Operations.
6. Image Enhancement Using Intensity Transformations.
7. Histogram Equalization.
8. Spatial Filtering.
9. Enhancement Using the Laplacian.

Course Articulation Matrix

Course Outcomes	CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak														
	POs												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
1.	2					3							3	3	3
2.			3		2	3	2					2		2	
3.			3						2			3	1		3
4.			3		3				3			3	3	3	3

SUBJECT CODE: 21UEC611N	Simulation and Modeling of Physical Systems	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

Introduction to Systems: Introduction, types, properties of systems, LTI Systems, Stability of systems. Non linear systems

Mathematical Modeling: Introduction, types of modeling, Abstraction, Linearity and superposition, balance and conservation laws and the system, boundary approach. Basic system elements in mechanical, electrical, fluid, magnetic and thermal systems

UNIT–II	xx Hrs.

Mathematical Modeling of Basic Engineering Systems: Introduction, Differential equations of basic engineering systems, Transfer functions, Block diagram algebra, Signal flow graphs.

Lumped Parameter Models: Mechanical systems (automobile suspension system, accelerometer), translational, rotational (simple rotational system). hydraulic systems (two tank hydraulic system), thermal systems (simple thermal system). Electrical Systems (capacitor microphone).

UNIT–III	xx Hrs.

Analysis of Systems: Introduction, time domain analysis of first order and second order systems**,** Frequency response of Linear Time invariant systems: Bode plots, phase margin and gain margin, stability analysis: Routh Hurvitz criteria. Introduction to State space representation of systems

UNIT–IV	xx Hrs.

Modeling and Simulation tools: Introduction, familiarization with modeling and simulation software, Simulation and analysis of mathematical models developed. Introduction to non-linear systems and linearization. Curve fitting in system modeling.

Reference Books *

1. Mukherjee A. and Karmakar R. - „Modeling and Simulation of Engineering Systems through Bond graphs - Narosa – 2000
2. I J Nagrath, M Gopal – Control Systems Engineering, New Age International Publishers, Fifth Edition, 2007
3. O. Beucher and M. Weeks - Introduction to MATLAB and Simulink a project based Approach, Infinity Science Press LLC, 2006
4. Chi Tsong Chen – Linear System Theory and Design, Oxford University Press, 1999
5. Ken Dutton, Steve Thompson, Bill Barraclough – The Art of Control Engineering, Addison – Wesley, 1997
6. J N Kapur – Mathematical modeling, New Age International (P) Ltd. New Delhi
7. S. C. Chapra, R. P. Canale – Numerical methods for Engineers, 4th Ed., TMH, New Delhi
8. Woods Robert L. and Kent L.- „Modeling and Simulation of Dynamic Systems"- Prentice Hall – 1997
9. Frederick C. - „Modeling and Analysis of Dynamic Systems" - Wiley - 2001 - 3rd Edition

Course Outcomes**
After completion of the course student will be able to 1. Build a reduced order model of any engineering system and obtain its mathematical model 2. Visualize various factors to be considered in any engineering system design **3.** Simulate the developed model Use software tools (e.g. SCILAB/XCOS) for modeling, simulation, and analysis **4.** Analyze the system using simulation results

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
CO2	3	3	3	0	0	1	2	0	0	0	0	0	3	0	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0

SUBJECT CODE: 21UEC612N	Nanotechnology	Credits: 03
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	xx Hrs.

Introduction: The Canvas of nano science and nanotechnology: - Nano and nature, Evolution of various technologies of the 20th century, Beginning of Nano. Introduction to Fullerenes: Introduction to fullerenes, Synthesis & purification of fullerenes, Conductivity & superconductivity in Fullerenes, Introduction, synthesis & purification of CNTs, filling & mechanism of growth of CNTs, Electronic structure, mechanical and physical properties of CNTs, applications of CNTs.

UNIT–II	xx Hrs.

Semiconductor quantum dots: Introduction, synthesis of quantum dots, electronic structure of nano crystals. Nano shells: Introduction, types of nano shells, properties and characterization. Nano sensors: Introduction, Nano sensors, Nano sensors based on quantum size effects, electrochemical sensors, Nano biosensors and smart dust.

UNIT–III	xx Hrs.

Molecular Nano machines: Introduction, covalent and non-conventional approaches, molecular motors and machines, molecular devices, single molecule devices. Nano tribology: Introduction, studying tribology the nano scale, nanotribology applications. Case study: design and development of CNT based nano piezoresistive pressure sensor, Silicon nano wire- based sensors.

UNIT–IV	xx Hrs.

Investigation & characterization methods in the nano scale: Electron Microscopes, Scanning Probe Microscopes, optical microscopes for nontechnology, other microscopes, X-ray diffraction, AFM. Societal implications of nano science & nontechnology: From first industrial revolution to the nano revolution, implications of nano science and nontechnology on society, nanotech and war, public perception and involment in the nano discourse, harnessing nontechnology for economic and social development.

Reference Books *

1. T. Pradeep,"NANO: The Essentials", McGraw-Hill Education, 2007 Edition. .
2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley-VCH, 3rdEdition, 2012 Year

Course Outcomes**

After completion of the course student will be able to

1. **Comprehend the fundamentals of nontechnology and develop an understanding of various nano materials and synthesis technology.**
2. **Understand quantum dots, nano shells, design and development of Nano sensors**

3. **Comprehend the knowledge of molecular nano mechanics & Nano tribology**
4. **Analyze and characterize nano devices, nanostructures and comprehend the societal implications of nanotechnology.**

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	0	0	0	0	0	0	0	3	0	2	3	1	0
CO2	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO3	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO4	3	3	1	2	3	3	3	3	0	2	2	3	3	3	0

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

Semester End Examination (SEE) Scheme of Evaluation

Semester: VI Course: Mini-Project Code: 21UEC613P Credits:02 Hours/Week:03

Mini-Project is evaluated as per the guidelines of BEC Examination Reforms Policy. It is evaluated for 50 marks by a committee comprising of 1. Mini-Project Coordinator, 2. HoD/Nominee and 3. External Examiner. The details of evaluation are as follows.

Evaluation Criteria	**Very poor (2)**	**Poor (4)**	**Average (6)**	**Good (8)**	**Very good (10)**	**Total marks**	**Evaluation Committee**
1. Generate information through appropriate tests to improve or revise design-GA	Not able to identify suitable tests to be done	Able to identify but not able to follow testing procedures	Able to follow testing procedures but not able to collect information	Able to collect information but not able to apply it for improvement	Able to apply information for the improvement	50	Coordinator + HoD/ Nominee + External Examiner
2. Use appropriate procedures, tools and techniques to conduct experiments and collect data - GA	Not able to identify tools, techniques and procedures	Able to identify but not able to conduct experiments	Able to conduct experiments but not able to follow procedure	Able to follow procedure but not able to collect data	Able to collect data as per the standards		
3. Analyze data for trends and correlations	Not able to understand data	Able to understand but not able to analyze data	Able to analyze data but not able to correlate them	Able to correlate but not able to identify errors and limitations	Able to identify errors and limitations		

4. Deliver effective oral presentations to technical and non-technical	Could not deliver effective presentati ons.	Could not deliver presentation ,but presentation was	Able to deliver fair presentation but notable to answer to the audiences	Deliver effective presentat io ns but able to answer partially to	Deliver effective presentation and able to answer all queries of the		

audiences-IA		prepared and attempted.		the audience querries.	audience.		
5. Present results as a team, with smooth integration of contributions from all individual efforts – GA+ IA	No Contribution from an individual to a team	Contributions from an individual to a team is minimal	Contributions from an individual to a team is moderate	A contribution from an individual to a team is good but not well groomed in team.	Contribution from an individual to a team is good and results in an integrated team presentation.		

GA–Group Assessment **IA** –Individual Assessment