NEW HORIZON COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC

Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka

Awarded Outstanding Technical Education Institute in Karnataka

Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

Academic Year 2017-18

ECE - Electronics & Communication Engineering

Fifth and Sixth Semesters
Scheme and Syllabus

CONTENTS

VISION

To create high quality engineering professionals who can serve the society and earn global recognition.

MISSION

- To build strong foundation in Electronics and Communication Engineering aspects by exposing students to state of the art technology and research.
- To strengthen the curriculum through interaction with industry experts to equip the students with the required competency.
- To mould students to share technical knowledge and to practice professional and moral values.

Program Education objectives (PEOs)

PEO1	To produce graduates with understanding of fundamentals and applications of Electronics and Communication Engineering.
PEO2	To hone graduates with ability to apply, analyze, design and develop electronic systems.
PEO3	To enhance graduates with latest technologies to enable them to engineer products for real world problems.
PEO4	To build leadership qualities, management skills, communication skills, moral values, team spirit and lifelong learning ability for the graduates.

PEO to Mission Statement Mapping

Mission Statements	**PEO1**	**PEO2**	**PEO3**	**PEO4**
To build strong foundation in Electronics and Communication Engineering aspects by exposing students to state of the art technology and research.	3	3	3	2
To strengthen the curriculum through interaction with industry experts to equip the students with the required competency.	2	3	3	2
To mould students to share technical knowledge and to practice professional and moral values.	1	2	2	3

Correlation: 3- High, 2-Medium, 1-Low

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	**Engineering knowledge**	**PO1:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems in Electronics and Communication Engineering.
2	**Problem analysis**	**PO2:** Identify, formulate, review research literature, and analyze complex engineering problems in Electronics and Communication Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions**	**PO3:** Design solutions for complex engineering problems and design system components or processes of Electronics and Communication Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems**	**PO4:** Use research-based knowledge and research methods including design of experiments in Electronics and Communication Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage**	**PO5:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Electronics and Communication Engineering with an understanding of the limitations.
6	**The engineer and society**	**PO6:** 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 in Electronics and Communication Engineering.
7	**Environment and sustainability**	**PO7:** Understand the impact of the professional engineering solutions of Electronics and Communication Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics**	**PO8:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work**	**PO9:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10	**Communication**	**PO10:** 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.
11	**Project management and finance**	**PO11:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning**	**PO12:** 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.

Program Specific Outcomes

PSO1	To demonstrate the ability to design and develop complex systems in the areas of next generation Communication Systems, IoT based Embedded Systems, Advanced Signal and Image Processing, latest Semiconductor technologies, RF and Power Systems.
PSO2	To demonstrate the ability to solve complex Electronics and Communication Engineering problems using latest hardware and software tools along with analytical skills to contribute to useful, frugal and eco-friendly solutions.

Mapping of PEOs to POs & PSOs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PEO1	3	3	2	2	2	1	1	1	1	1	1	1	1	1
PEO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2
PEO3	3	3	3	3	3	3	3	2	2	2	2	2	3	3
PEO4	1	1	1	1	1	2	2	3	3	3	3	3	1	1

Correlation: 3- High, 2-Medium, 1-Low

New Horizon College of Engineering, Bangalore

B.E. Program - Batch: 2015 -2019

Department of Electronics and Communication Engineering

Scheme of Fifth and Sixth Semester

Third Year / Fifth Semester												
Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	ECE51	Analog Communication	3	2	0	0	5	3	4	75	75	150
2	ECE52	Microcontrollers	3	2	0	0	5	3	4	75	75	150
3	ECE53	CMOS VLSI Design	3	2	0	0	5	3	4	75	75	150
4	ECE54	Information Theory and Coding	3	0	0	0	3	3	0	50	50	100
5	ECE55	Engineering Electromagnetics	3	0	1	0	4	5	0	50	50	100
6	ECE56X	Professional Elective – I	3	0	0	1	4	3	0	50	50	100
		TOTAL					**26**	**20**	**12**	**375**	**375**	**750**

Third Year / Sixth Semester												
Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	ECE61	Digital Communication	3	2	0	0	5	3	4	75	75	150
2	ECE62	Embedded System Design	3	2	0	0	5	3	4	75	75	150
3	ECE63	Microelectronic Circuits	4	0	0	0	4	4	0	50	50	100
4	ECE64	Microwaves and Radar	4	0	0	0	4	4	0	50	50	100
5	ECE65X	Professional Elective – II	3	0	0	1	4	3	0	50	50	100
6	NHOPXX	Open Elective – I	3	0	0	1	4	3	0	50	50	100
		TOTAL					**26**	**20**	**8**	**350**	**350**	**700**

New Horizon College of Engineering, Bangalore

B.E. Program - Batch: 2015 -2019

Department of Electronics and Communication Engineering

Academic Year: 2017 – 2018

Syllabus of Fifth Semester

Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	ECE51	Analog Communication	3	2	0	0	5	3	4	75	75	150
2	ECE52	Microcontrollers	3	2	0	0	5	3	4	75	75	150
3	ECE53	CMOS VLSI Design	3	2	0	0	5	3	4	75	75	150
4	ECE54	Information Theory and Coding	3	0	0	0	3	3	0	50	50	100
5	ECE55	Engineering Electromagnetics	3	0	1	0	4	5	0	50	50	100
6	ECE56X	Professional Elective – I	3	0	0	1	4	3	0	50	50	100
		TOTAL					**26**	**20**	**12**	**375**	**375**	**750**

Professional Elective – I (GROUP 1)

ECE561: Digital Experience Management using Adobe Experience Manager

ECE562: Virtualization Essentials using VMware

ECE563: Big Data Analytics with HP Vertica

ECE564: Optical Fiber Communication

ANALOG COMMUNICATION			
Course Code	**: ECE51**	**Credits**	**:05**
L: P: T: S	**: 3:2:0:0**	**CIE Marks**	**:50+25**
Exam Hours	**: 3+3**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Compare the Generation and Detection of Analog modulation techniques
CO2	Apply the knowledge of Fourier transform and its properties for Analog modulation techniques
CO3	Apply the concept of Hilbert transform to express the complex envelope of band pass signals
CO4	Evaluate the Power consumption and Bandwidth utilization in Analog modulation techniques
CO5	Illustrate the random process and develop applications for societal benefits with minimal noise effects
CO6	Conduct experiments to demonstrate the concepts of Analog communication and its applications

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	2	2	1	-	-	-	-	-	-	3	3
CO6	-	-	-	-	-	-	-	-	2	2	-	2	-	3

Module No	Module Contents	Hrs.	COs
1	AMPLITUDE MODULATION: Introduction, Time domain description of AM wave, Frequency domain description of AM wave, Generation of AM wave- Square law modulator. Detection of AM wave-Envelope detector. Double side band suppressed carrier modulation (DSB-SC): Time domain description of DSB-SC wave, Frequency domain description of DSB-SC wave, Generation of DSB-SC wave- Balanced modulator, Detection of DSB-SC wave - Costas Receiver, Quadrature carrier multiplexing.	9	CO1 CO2 CO4 CO6
	List of Experiments 1. Amplitude modulation using BJT/FET (Generation and Detection) - Hardwired as well as SPICE coding 2. PWM and PPM 3. Pulse amplitude modulation and detection	6	
2	SINGLE SIDE-BAND MODULATION (SSB): Hilbert transform, Properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals, Frequency domain description of SSB wave, Time domain Description of SSB wave, Phase discrimination method for generating an SSB wave, Demodulation of SSB wave	9	CO1 CO3 CO4 CO6

	List of Experiments 1. Second order active filters (LPF,HPF,BPF,BEF) – Hardwired as well as SPICE coding 2. Design and test a Schmitt Trigger circuit for the given values of UTP and LTP	6	
3	VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency domain description, Time domain description, Generation of VSB modulated wave, Envelope detection of VSB wave plus carrier, Comparison of modulation techniques, Frequency translation, Frequency Division Multiplexing, Radio receivers- Receiver types, AM receivers.(Ref book 1 for Radio receivers)	9	CO1 CO3 CO4 CO6
	List of Experiments 1. IF amplifier design 2. Astable and Monostable multivibrator circuits using 555 timer	6	
4	ANGLE MODULATION: Basic definitions for FM and PM, Narrow band FM, Wide band FM, Transmission bandwidth of FM waves, Generation of FM wave- Indirect FM and Direct FM, Demodulation of FM wave- Frequency Discriminator, Zero crossing detector, Linear and Non Linear model of the Phase Locked Loop.	9	CO1 CO2 CO4 CO6
	List of Experiments 1. Frequency modulation - using 8038/2206 as well as SPICE coding 2. Frequency synthesis using PLL	6	
5	RANDOM PROCESSES: Introduction, Mathematical Definition of Random process, Mean, Correlation and Covariance Functions, Power Spectral Density, Gaussian Process. NOISE: Introduction, Types of Noise, Noise equivalent bandwidth, Noise Figure, Equivalent Noise temperature, Cascade connection of Two-port networks, Noise in CW Modulation Systems: Noise in DSB-SC Receivers, Noise in AM Receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM	9	CO5 CO6
	List of Experiments • Design and test R-2R DAC using op-amp • Precision rectifiers – both Full Wave and Half wave	6	

Text Books:

1.Communication Systems, Simon Haykin, 5th Edition, 2013, John Willey India Pvt. Ltd.

2. An Introduction to Analog and Digital Communication, Simon Haykin, 2008, John Wiley India Pvt. Ltd.

Reference books:

1.Electronic communication systems, Kennedy and Davis, 5th edition, 2011, TMH.

2.Modern digital and analog Communication systems, B. P. Lathi, 3rd edition, 2015, Oxford University Press.

3.Communication Systems - Analog and digital, Singh and Sapre, 2nd edition, 2007, TMH.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-curricular Activities
Marks	**25**	**10**	**5**	**10**
Remember	10	-	-	-
Understand	10	-	-	-
Apply	5	5	-	5
Analyze	5	-	5	-
Evaluate	5	5	-	5
Create	-	-	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	10	5
Apply	5	-
Analyze	-	-
Evaluate	-	-
Create	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	20
Understand	10
Apply	10
Analyze	10
Evaluate	-
Create	-

Practical (25 Marks)

Bloom's Taxonomy	Tests
Marks	**25**
Remember	10
Understand	5
Apply	10
Analyze	-
Evaluate	-
Create	-

MICROCONTROLLERS			
Course Code	**: ECE52**	**Credits**	**:05**
L: P: T: S	**: 3:2:0:0**	**CIE Marks**	**:50+25**
Exam Hours	**: 3+3**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Describe the architectural features of 8086 Microprocessor
CO2	Describe the architecture of 8051 Microcontroller and to aspire design aspects of I/O and Memory interfacing circuits
CO3	Apply the basic knowledge of addressing modes to write assembly language program in 8051 Microcontroller
CO4	Analyze the code in assembly level for application of 8051 Timers, Interrupts and Serial Communication interface
CO5	Use modern tools and engage in self learning to carry out real world projects
CO6	Design an 8051 system by interfacing to external memory and I/O Peripherals

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	3	-	-	-	3	-	-	-	3	-
CO4	3	3	-	-	3	-	-	-	3	-	-	-	3	2
CO5	3	3	2	2	3	-	-	-	3	-	-	1	-	2
CO6	3	3	2	2	3	-	-	-	3	-	-	-	-	2

Module No	Module Contents	Hrs.	COs
1	Introduction: Digital Computer, Microprocessors, Microcontrollers for embedded Systems8086 Microprocessor : 8086 CPU architecture, General Purpose Registers, Segment registers, PSW, Addressing modes, Instruction set summary ,Assembly language programming pin diagram in minimum mode	9	CO1 CO5
	List of Experiments 1. 8086 programs using MASM 2. Basic arithmetic and Logical operations 3. Code conversion and string operations	6	
2	8051 Microcontroller: Architecture, Working Registers, Special Function Registers(SFRs), I/O ports functions, Memory organization, External Memory (ROM & RAM) interfacing, Addressing Modes	9	CO2 CO5
	List of Experiments 1. Programming using data transfer instructions (block transfer, exchange sorting) in microprocessor	6	
3	8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Stack and Subroutine instructions, Bit manipulation instruction., Assembler directives, Assembly language program examples	9	CO3 CO5

	List of Experiments 1. Programming using arithmetic instructions of 8051(16 bit) 2. Logical and Bit manipulations instructions. 3. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .	6	
4	8051 Timers and Counters – Operation and Assembly language programming 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Assembly language programming for 8051 serial data transmission and reception, 8051 Interrupts and 8051 Assembly language Interrupts programming	9	CO4 CO5
	List of Experiments 1. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller	6	
5	8051 Interfacing and Applications: Interfacing 8051 to simple switches and LEDs, LCD, ADC-0804 and Stepper motor and 8051 Assembly language Interfacing programming.	9	CO5 CO6
	List of Experiments(Assembly level programming) 1. Interfacing ADC and 8051 based temperature measurement 2. Interfacing – LED and LCD 3. Interfacing – stepper motor traffic light control	6	

Text Books:

1. The 8051 Microcontroller and Embedded Systems – using assembly and C , Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, 2nd Edition, 2006, Pearson.
2. Microcomputer Systems - The 8086/8088 Family Architecture, Programming and Design, Yu-cheng Liu and Glenn A. Gibson, 2nd Edition, 2015, Pearson.

Reference books:

1. Microprocessors and Interfacing – Programming & Hardware Douglas Hall, 2nd edition, 1990, McGraw Hill.
2. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, 2nd edition, 2007, Pearson education.
3. Microprocessors and Microcontrollers: Architecture, Programming and System Design, Krishna Kant, 2007, PHI.
4. The Intel Microprocessors Architecture, Programming and Interfacing, Barry B. Brey, 2007, Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-curricular Activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	5	-	-	-
Apply	5	5	5	5
Analyze	10	-	-	-
Evaluate	-	-	-	5
Create	-	5	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	10	5
Apply	5	-
Analyze	-	-
Evaluate	-	-
Create	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	20
Understand	10
Apply	10
Analyze	10
Evaluate	-
Create	-

Practical (25 Marks)

Bloom's Taxonomy	Tests
Marks	**25**
Remember	10
Understand	5
Apply	10
Analyze	-
Evaluate	-
Create	-

CMOS VLSI Design			
Course Code	**: ECE53**	**Credits**	**:05**
L: P: T: S	**: 3:2:0:0**	**CIE Marks**	**:50+25**
Exam Hours	**: 3+3**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Illustrate the basic concepts of MOS Transistors
CO2	Identify the current trends' in architectures of CMOS VLSI design
CO3	Examine the process sequence of IC manufacturing technology
CO4	Make use of CMOS layout design rules for realization of digital circuit layouts
CO5	Evaluate the performance issues in the Analog Design
CO6	Distinguish the faults occuring in Combinational and Sequential circuits of digital systems

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	3	-	-	-	3	-
CO2	3	3	3	3	3	-	-	-	3	-	-	-	3	-
CO3	3	3	3	3	3	-	-	1	3	-	-	-	3	-
CO4	3	3	-	-	3	-	1	-	3	-	-	3	3	-
CO5	3	3	3	3	3	1	-	-	3	-	2	3	3	-
CO6	3	3	3	3	3	-	-	-	3	-	2	3	3	1

Module No	Module Contents	Hrs.	COs
1	INTRODUCTIN: Historical Perspective, Introduction to IC Technology, Types of ICs, VLSI Design Methodology, Design Domains - Y chart, Hierarchical Abstraction, VLSI Design Steps, VLSI Design Styles, Computer-aided Design, IC Chip Industry – A Brief Outlook, Recent Developments and Future Projections. MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, VLSI Design Flow, Fabrication, Packaging, and Testing, Exercises on Stick diagrams using Euler path.	9	CO1 CO2
	List of Experiments 1. Draw the schematic of i) CMOS Inverter, ii) Transmission gate, for the given specifications, and verify using Transient and DC Analyses. 2. Draw the schematic of i) 2-input CMOS NAND gate, ii) 2-input CMOS NOR gate for the given specifications, and verify using Transient and DC Analyses.	6	
2	MOS TRANSISTOR THEORY: Introduction, Ideal I-V characteristics, Non ideal I-V effects, DC transfer characteristics, Switch-level RC delay models. CMOS Processing Technology: CMOS Technologies, Layout Design Rules, CMOS Process Enhancements.	9	CO3 CO4
	List of Experiments 1. Draw the layout of i) CMOS Inverter, ii) Transmission gate, and perform physical verification using DRC, ERC and LVS. Extract RC and back annotate the same and verify the Design. 2. Draw the layout of i) 2-input CMOS NAND gate, ii) 2-input CMOS NOR gate, and perform physical verification using DRC, ERC and LVS. Extract RC and back annotate the same and verify the Design.	6	

3	Digital CMOS LOGIC DESIGN: Classification of CMOS Digital Logic Circuit, Combinational Logic Circuit, Sequential Logic Circuit, Pseudo-nMOS Logic, CMOS Transmission Gate, Dynamic and Domino CMOS Logic, NORA and Zipper CMOS Logic, TSPC Dynamic CMOS Logic, PTL and CPTL, Voltage Bootstrapping, Differential CMOS Logic, Adiabatic Logic, DTCMOS Logic.Semiconductor Memories, BiCMOS Technology and Circuits.	9	CO2
	List of Experiments 1. For the following circuits, write the switch level Verilog Code, and verify using Test Bench: i) CMOS inverter, ii) 2-input CMOS NAND and NOR gates 2. For the following circuits, write the switch level Verilog Code and verify using Test Bench: i) 2-input EXOR gate using CMOS logic, ii) 2-input EXOR gate using PTL 3. Synthesize the following circuits using the gate level Verilog Code, with the given Constraints: i) CMOS inverter, ii) 2-input CMOS NAND and NOR gates	6	
4	**TIMING ANALYSIS:** Delay in general, Slew Balancing & Transistor Equivalency, Design of 2-Inputs NAND & NOR Gates for Equal Rise and Fall Slew, MOS Capacitances, Design Techniques for Delay Reduction, Intrinsic Delay of Inverter and its Sizing Effect on Propagation Delay, Inverter Chain Design, Logical Effort, Timing Analysis & Models & Goals, Static vs Dynamic Timing Verification, Factors Impacting Timing Delay, Static Timing Analysis - Case Study, Fixed Delay Model & Timing Constraints, Timing Verification in Sequential Synchronous Circuits, Issues with Static Delay Modeling, First-order Gate Delay Model & Parasitic Extraction, Timing Convergence Problem, Timing-Driven Logic and Layout Synthesis.	9	CO5
	List of Experiments For the following circuits, write the Verilog Code, verify using Test Bench, and then synthesize with the given Constraints:i) 4-bit Parallel adder, ii) D Flip-flop, iii) T Flip-flop,iv) 4-bit Synchronous counter	6	
5	TESTING AND VERIFICATION: Introduction, Testers, Test Fixture and Test Programs, Logic Verification Principles, Silicon Debug Principles, Manufacturing Test Principles, Design for Testability, Boundary Scan, Testing in a University Environment.	9	CO6
	List of Experiments 1. Draw the schematic of i) Common source, ii) Common Drain amplifier, for the given specifications, and verify using Transient, DC and AC Analyses. 2. Draw the layout of i) Common source, ii) Common Drain amplifier, and perform physical verification using DRC, ERC and LVS. Extract RC and back annotate the same and verify the Design. 3. Draw the schematic of i) Differential Amplifier, ii) Op- amp, for the given specifications, and verify using Transient, DC and AC Analyses. 4. Draw the layout of i) Differential Amplifier, ii) Op-amp, and perform physical verification using DRC, ERC and LVS. Extract RC and back annotate the same and verify the Design.	6	

Text Books:

1. CMOS VLSI Design – A Circuits and Systems Perspective, N.H. Weste, David Harris, Ayan Banerjee, 3rd Edition, 2010, Pearson Education.
2. VLSI Design, Debaprasad Das, 2nd edition, 2016, Oxford University Press

Reference books:

1. MOS VLSI Design – A Circuits and Systems Perspective, N.H. Weste and David Harris, 4th Edition, 2014, Pearson Education (http://www.cmosvlsi.com)
2. CMOS Digital Integrated Circuits, Analysis and Design, Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, 2007, TMH.
3. Digital Integrated Circuits – A design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Edition, 2009, Prentice-Hall.
4. Basic VLSI Design, Douglas A. Pucknell and Kamran Eshraghian, 3rd Edition, 2011, PHI.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-curricular Activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	5	5	-	-
Apply	10	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	5	5
Apply	10	-
Analyze	-	-
Evaluate	-	-
Create	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

Practical (25 Marks)

Bloom's Taxonomy	Tests
Marks	**25**
Remember	10
Understand	5
Apply	10
Analyze	-
Evaluate	-
Create	-

INFORMATION THEORY AND CODING			
Course Code	**: ECE54**	**Credits**	**:03**
L: P: T: S	**: 3:0:0:0**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Identify the importance of Information and coding techniques essential for communication system
CO2	Analyze various Information sources and channel capacities
CO3	Illustrate the significance of source coding and channel coding techniques for digital communication systems
CO4	Realize the coding and decoding techniques for digital communication design
CO5	Estimate the error detection and correction capabilities of channel codes for error free communication
CO6	Examine various statistical approaches for signal detection

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	2	-	-	-	-	-	3	3	-
CO6	3	3	-	-	-	2	-	-	-	-	-	3	3	-

Module No	Module Contents	Hrs.	COs
1	Information Theory Introduction, Uncertainty, Information and its property, Entropy and its property, Joint and Conditional Entropy, Mutual Information and its property, Information measures for Continuous random variables.	9	CO1 CO2
2	Channel classification and Capacity: Channel capacity theorem, Continuous and Discrete Communication channels – Discrete memory less channels - channel representations - noiseless channel, lossless channels, Deterministic, Binary symmetric channel (BSC), Binary Erasure channel (BEC) and their capacities.	9	CO1 CO2 CO3
3	Source Coding Techniques: Coding for Discrete memory less sources: – Fixed length code words, Variable length code words, Kraft Inequality, Prefix coding, Shannon‟s first , second and third theorem, Shannon binary Encoding, Shannon-Fano Encoding, Huffman Coding : minimum and maximum variance method, Arithmetic Coding, Dictionary Coding- LZ , LZW Coding	9	CO3 CO4 CO5
4	Error Control Coding: Types of Errors, Types of Codes, Linear Block Codes: Error Detection and Error Correction Capabilities of Linear Block codes, Binary Cyclic codes , Encoding using Shift register, Syndrome Calculation, Error detection, and Error correction, Convolutional codes – Encoders and Decoders for convolutional codes, LDPC Codes, Trellis Codes, Turbo Codes, Viterbi Coding.	9	CO3 CO4 CO5

5	Detection of Signals and Channels with Noise : Hypothesis testing – Baye's criterion – Minimum error probability criterion, Neyman Pearson criterion, Minma criterion-Maximum Likelihood detector-Wiener filter-Continuous and Discrete channels with noise.	9	CO1 CO5 CO6

Text Books:

1. Digital and analog communication systems, K. Sam Shanmugam, 2006, John Wiley.
2. Communication Systems, Simon Haykin, 2009, John Wiley and Sons.

Reference books:

1. Information Theory, Coding and Cryptography, Ranjan Bose, 2012, Tata McGraw Hill.
2. Elements of Information Theory, Thomas M. Cover and Joy A. Thomas, 2004, John Wiley and Sons.
3. Digital Communications: Fundamentals & Applications, Bernard Sklar, 2nd edition, 2009.
4. Digital Communication, Meinel C. and Sack H., 2014, Springer publications.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular Activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	5	5	-	-
Apply	10	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	-

ENGINEERING ELECTROMAGNETICS			
Course Code	**: ECE55**	**Credits**	**:04**
L: P: T: S	**: 3:0:1:0**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Apply vector concepts for laws and theorem in electromagnetics fields
CO2	Apply the static characteristics of electromagnetic fields to different charge and current distribution
CO3	Analyze the boundary characteristics of electromagnetic fields on different media
CO4	Illustrate the concept of capacitance and inductance using electromagnetic fields
CO5	Categorize the Maxwell's Equations for static and time varying electromagnetic fields
CO6	Analyze the characteristics of electromagnetic waves over different media

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	3	3	-	-	-	-	3	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO6	3	3	-	-	-	3	3	-	-	-	-	3	3	-

Module No	Module Contents	Hrs.	COs
1	**FUNDUMENTALS OF ELECTROSTATICS:** Vector analysis**,** Experimental law of Coulomb, Electric field intensity, Electric flux density, Gauss' law, Maxwell's First equation(Electrostatics), divergence theorem, 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 gradient.	9	CO1 CO2 CO4
2	**PROPERTIES OF ELECTROSTATICS AND BOUNDARY CONDITIONS :** Current and current density, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, Derivations of Poisson's and Laplace's Equations, Examples of the solutions of Laplace's and Poisson's equations.	9	CO2 CO3
3	**INTRODUCTION TO MAGNETOSTATICS:** Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials.	9	CO1 CO2 CO4
4	**TIME VARYING FIELDS AND MAXWELL'S EQUATIONS:** Magnetic circuit, Inductance and Mutual Inductance, Faraday's law, displacement current, Maxwell's equation in point and Integral form.	9	CO5

5	**UNIFORM PLANE WAVES AND THEIR PROPERTIES AT BOUNDARIES:** Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors – (skin effect), Reflection of uniform plane waves at normal incidence, SWR.	9	CO6

Text Book:

1. Engineering Electromagnetics, William H Hayt Jr. and John A Buck, 8th edition, 2014, Tata McGraw-Hill.

Reference books:

1. Electromagnetics with Applications, John Krauss and Daniel A Fleisch, 5th edition, 1999, McGraw-Hill.
2. Electromagnetic Waves And Radiating Systems, Edward C. Jordan and Keith G Balmain, 2nd edition, 2002, Prentice – Hall of India / Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular Activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	10	5	-	-
Apply	5	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

DIGITAL EXPERIENCE MANAGEMENT USING ADOBE EXPERIENCE MANAGER			
Course Code	**: ECE561**	**Credits**	**:04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Gain a fresh perspective on online marketing in a global scenario. Understand the concepts of object oriented programming in JAVA
CO2	Understand the programming concepts in Web scripting languages and will be able develop web pages using scripting languages
CO3	Understand the architecture, technologies and frameworks in Adobe Experience Manager
CO4	Create online web pages, Digital asset management and campaigning using AEM
CO5	Integrate new digital marketing techniques into the strategic marketing plan using AEM. Drive change and foster innovation in Digital Marketing with AEM

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	1	2	-	-	-	2	2	1	-	-
CO2	2	3	2	3	1	2	-	-	-	2	2	1	-	-
CO3	2	3	2	3	1	2	-	-	-	2	2	1	-	-
CO4	2	3	2	3	1	2	-	-	-	2	2	1	-	-
CO5	2	3	2	3	1	2	-	-	-	2	2	1	-	-

Module No	Module Contents	Hrs.	COs
1	Introduction to DM & AEM Getting started with DM: What is online marketing? Characteristics of good domain name? What is digital marketing? Different methods of digital Marketing, Main methods of DM, Search engine optimization, pay per click & display advertising, email marketing, content marketing, social media marketing. Introduction Object Oriented Programming with JAVA Fundamentals: Class Objects, Methods, Constructor, this reference, inheritance, and polymorphism, Introduction to JSP	8	CO1
	Hands on : Write a program to calculate and area of four different geometric shapes: triangles, squares, rectangles, and circles. Use Method overriding. Employee program to create n object to find gross salary. Data: empid, empname, gender, basic, hra = 25% of basic, DA = 125% of basic, CCA=Rs 300, IT=10% if gross >1L. • Display all information. • Use constructors • Implement required methods. Student program to create n objects to find Grade. Data: usn,studname,sem, sub name[ ],sub marks[],percentage, Grade. 90 - 100 = S 80 – 89 = A 70-79 =B 60 – 69 = C	4	

	50 – 59 = D 40 – 49 =E < 40 = F		
2	**Introduction to Scripting Languages:** **Web and XHTML:** Internet, WWW, Web Browsers and Web Servers, URLs, HTTP, **XHTML:** Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames **CSS:** Introduction, Levels of style sheets, formats, selector forms, The box model, conflict resolution. **JavaScript:** Overview , Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Arrays, Functions, Pattern matching using regular expressions, Errors in scripts. **Introduction to Sightly**	9	CO2
	Hands on: 1. Create a web page using HTML forms for email registration. 2. Create a web page using HTML frames. 3. Develop a XHTML file that includes JavaScript script for that accepts a number n using prompt and outputs the first n Fibonacci numbers 4. Develop a XHTML file that includes JavaScript script for that accepts a number n using prompt and outputs a table of numbers from 1 to n and their squares using alert **5.** Develop a web page using HTML and apply the various CSS styles. Develop a web page using HTML and apply selector forms.	4	
3	**Getting started with AEM:** Introduction to Web content management, History of AEM ,The adobe marketing cloud, Install & deploy AEM, Author Instance, Publish Instance, AEM Consoles: Authoring in AEM, work with user interfaces: Classic UI, Touch optimized UI, AEM web console: OSGi management console, CRX Explorer, CRXDE Lite. **AEM Architecture** OSGi framework: Introduction, AEM functional building blocks, Architecture stack, OSGi framework. Content Repository: JCR, Jackrabbit Oak, Adobe CRX Web Framework: REST, Apache Sling.	9	CO3
	Hands on: **1.** AEM installation & deployment. **2.** Working in AEM Environment **3.** Familiarize yourself with a Repository structure. **4.** Create a Node and add properties.	4	
4	**Managing Content** AEM Authoring Framework —Templates, Create Templates, Components and Design ,components ,Create a Page-Rendering Component ,Modularize the Page Component ,Inheriting Foundation Components , Design , Adding a design to a page ,Creating Components and Include them in Scripts, Create a Top Navigation Component, Dialog Boxes ,Create Dialog Boxes for Components, Dialog Box -Classic-UI, touch-optimized UI ,Use Design Dialog Boxes for Global Content , Create a logo component**.**	9	CO4
	Hands On 1. Create the Structure of Your Website 2. Create a Template for Your Website 3. Create a Page-Rendering Component 4. Create a Website Structure 5. Modularize the Page Component 6. Inherit the Sightly Foundation Component Page	4	

	7. Add a Design to the Page 8. Create a Top Navigation Component and Include it in a Script 9. Create a Training Title Component 10. Create a Logo Component		
5	**Digital Asset Management, Mobile pages, Managing Campaign :** Introduction to DAM, Basic DAM functions, DAM Metadata, DAM Components, Finding Assets, Asset Management, Adding New content, Authoring Responsive& Mobile Pages, Managing Campaigns& Content Targeting	9	
	Hands on: 1. Create and customize asset share page 2. Add a predicate to the asset share page 3. Add an asset editor page 4. Versioning for assets 5. Create folders 6. Add CUG properties to folders 7. Use tags to organize assets 8. Edit images 9. Upload thumbnail 10. View references to assets 11. Edit metadata of an asset 12. Create a Page 13. Insert a New Paragraph 14. Edit the next Paragraph 15. Add an image from the content finder 16. Insert an image from your file system 17. Add more Components 18. Annotate a component 19. Move or delete a component 20. Working with responsive page Layout 21. Create a Mobile page 22. Add content to Mobile Page 23. Creating brand 24. Creating campaign 25. Defining a new segment 26. Create experiences 27. Turn a component into targeted component 28. Test the campaign	4	CO5

Text Books:

1. Ryan D Lunka ,―Adobe Experience Manager: Classroom in a Book―, 2014, Adobe Press
2. Shane closser , Adobe Experience Manager: Quick Reference Guide , 2014, Adobe Press
3. Shivanikarwal, Digital Marketing Handbook, 2015, Create Space Independent Publishing Platform.
4. RobertW.Sebesta , Programming the World Wide Web ,4th Edition, Pearson Eductaion , 2008
5. M.Deitel,P.JDeitel,A.B.Goldberg, Internet and World Wide Web How to Program,4th Edition, Pearson Education , 2004

6. Shivanikarwal , Digital Marketing Handbook: A Guide to Search Engine Optimization, Pay Per Click Marketing, Email Marketing, Social Media Marketing and Content Marketing , 2015 , CreateSpace Independent Publishing Platform
7. HerbertSchield , ―Java:The Complete Reference , 9th Edition, Oracle Press, Tata McGraw Hill.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Lab	Mini Project
Marks	**25**	**25**
Remember	-	-
Understand	-	-
Apply	-	-
Analyze	-	-
Evaluate	25	-
Create	-	25

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	-
Understand	-
Apply	-
Analyze	25
Evaluate	25
Create	-

VIRTUALIZATION ESSENTIALS USING VMWARE			
Course Code	**: ECE562**	**Credits**	**:04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Understand the common terms and definitions of Operating System, Cloud Computing and Virtualization
CO2	Learning the business benefits and considerations of VMware virtualization
CO3	Knowing various approaches to server virtualization, its relevance to the modern data center, available platforms and important features
CO4	Analyzing the implications of virtualization on Data Center Challenges
CO5	Enable to configure the VMware vSphere storage and network virtualization

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	1	-	-	1	2	1	1	3	2
CO2	2	2	2	2	2	1	-	-	1	2	1	1	3	2
CO3	2	2	2	2	2	1	-	-	1	2	1	1	3	2
CO4	2	2	2	2	2	1	-	-	1	2	1	1	3	2
CO5	2	2	2	2	2	1	-	-	1	2	1	1	3	2

Module No	Module Contents	Hrs.	COs
1	**Understanding Virtualization: Operating Systems Essentials:** Process Management, Memory Management and Storage Management. **Cloud Computing Essentials:** Introduction to Cloud Computing, Cloud Deployment Models, Challenges. **Virtualization Essentials:** Importance of Virtualization, Examining today's trends, Virtualization Software Operations: Virtualizing Servers, Virtualizing Desktop, Virtualizing Applications.	8	CO1
	List of programs: 1. Using vSphere WebClient. 2. Creating a Virtual Machine	4	
2	**VMware vSphere Virtualization Overview:** Introduction to Data Center Virtualization: Traditional Architecture, Virtual Architecture, Types of Virtualization. Understanding Hypervisors: Describing hypervisor, Type-1 Hypervisor, Type-2 Hypervisor. vSphere Products & Features: vSphere vMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection.	9	CO2
	List of programs: 1.Deploying Virtual Machines Using Cloning, Templates, and a Content Library 2.Modifying Virtual Machine Settings	4	
3	**Creating & Managing Virtual Machines**: Creating, Managing, Monitoring & Configuring VM: vSphere Client and vSphere Web Client, vSphere Web Client UI, Creating VM:VM Components, Installing Guest OS, Managing VM: Startup and Shutdown of VM's, Creating and Managing Snapshots, RDM, Configuring VM: Memory/CPU Hot Plug, Swap Files. Creating Clones, Templates & Content Libraries Cloning VM, Creating Templates, OVF Templates, Types of Content Library.	9	CO3

4	**vSphere Solutions to Data Center Challenges**: Data Center Challenges: Availability, Scalability, Optimization, Management, Application Upgrade & Cloud Challenges. vSphere for Scalability and Business Continuity: vSphere vMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection	9	CO4
	List of programs: 1. Managing Tasks, Events, and Alarms **2.** Using vSphere vApps, Managing Multitiered Applications	4	
5	**Understanding VMware vSphere Storage & Network Virtualization Storage Virtualization:** Storage Concepts, iSCSI Concepts, NFS Data stores, VMFS Data stores, Virtual SAN Data stores, Virtual Volume Network Virtualization: Introduction to vSphere Standard Switch, Configuring Standard Switch Policies, Introduction to vSphere Distributed Switch	9	CO5
	List of programs: 1.Using vSphere vMotion and Storage vMotion to Migrate Virtual Machines 2.Implementing a vSphere DRS Cluster	4	

Text Books:

1. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, Mastering VMware vSphere 6, Publisher: Sybex; 1 edition (24 March 2015).
2. Matthew Portnoy, Virtualization Essentials , 2nd Edition, Wiley India Pvt. Ltd

Reference books:

1. Thomas Kraus, Kamau Wanguhu, Jason Karnes , VMware Network Virtualization: Connectivity for the Software-Designed Data Center , VMware Press Technology 1st Edition.
2. Bill Ferguson , vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press , 1st Edition

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 Marks)

Bloom's Taxonomy	CIE	Lab
Marks	**25**	**25**
Remember	-	-
Understand	10	-
Apply	10	10
Analyze	5	-
Evaluate	-	-
Create	-	15

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	-
Understand	5
Apply	25
Analyze	-
Evaluate	-
Create	20

BIG DATA ANALYTICS USING HP VERTICA			
Course Code	**: ECE563**	**Credits**	**:04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Demonstrate SQL command in Oracle and Vertica Databases
CO2	Apply the features of Vertica in running database designer
CO3	Creation of projection , partition of table manually in Vertica
CO4	Apply Copy, Delete, Merge, Purge concepts in Vertica database
CO5	Apply the concepts of HDFS in designing multi node clustering in Hadoop
CO6	Demonstrate Hadoop ecosystem tools like Pig, HBase

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1	-	-	2	-	2	2	-	-
CO2	3	3	3	2	3	1	-	-	2	-	2	2	-	-
CO3	3	3	3	2	3	1	-	-	2	-	2	2	-	-
CO4	3	3	3	2	3	1	-	-	2	-	2	2	-	-
CO5	3	3	3	2	3	1	-	-	2	-	2	2	-	-
CO6	3	3	3	2	3	1	-	-	2	-	2	2	-	-

Module No	Module Contents	Hrs.	COs
1	**Introduction to SQL and HP Vertica:** Types of SQL, Data Types, Constrains, JOINS, Types of JOINS, Clause, Group by, Having, Order by, Where Clause with examples, SQL Alias, Views, Union, Union all, aggregate functions, Operators, SQL exists, Introduction to HP-Vertica Database, Vertica Analytics Platform, Columnar Orientation, Advanced Compression, High Availability, Automatic Database design, Massively Parallel Processing, Application Integration. **Hands on sessions** a. Creation of tables with constrains and insertion of values into tables b. Hands-on DML commands to apply different aggregate function, Group by-Having-Order by clause, Operators. c. Creation of views and working with joins	9	CO1 CO2

2	**HP Vertica- 1** Projections, Query Execution ,Vertica Transactions, Hybrid data store – WOS & ROS, Projection Design: Projection fundamentals, Projection types, Projection properties, Replication and Segmentation Database Designer, Comprehensive mode, Incremental mode, Sample data, Sample queries, DBD Advantages **Hands on sessions** a. Creation of schema, tables and execution of SQL statements on Vertica Database, b. Running Database designer c. Hands-on projections	9	CO2 CO3
3	**HP Vertica -2** Loading data via INSERT-COPY-MERGE, Deleting data in Vertica- delete vector, design for delete, process of deleting Truncate, Purge, Update, Partitioning, Tuple Mover- Move Out Parameter, Merge Out Parameter, Working with Vertica Management Console. **Hands on sessions** a. Loading data files from different sources to Vertica database. b. Verifying the log files after loading the data into Vertica database. c. Hands-on partitions	9	CO3 CO4
4	**Big Data Analytics with Hadoop** Big data overview, Introduction to Hadoop, Overview of Hadoop Distribution File Systems[HDFS] and Map reduce Operations Clustering types in Hadoop- Standalone mode, Pseudo distributed mode, Fully distributed mode. **Hands on Sessions :** a. Verifying Hadoop installation (Pseudo distributed mode) b. Java path, Hadoop location, Hadoop configuration files, Name Node setup, Job Tracker, Metadata files, Accessing Hadoop on browser	9	CO5
5	**Hadoop Ecosystem** Introduction to SQOOP, Overview of PIG – modes of pig, when to use PIG latin, Introduction to HIVE- data types, architecture, Introduction to HBASE- comparison of Hadoop hdfs and HBASE, how data stored in HBASE . **Hands on Sessions :** a. Moving data from local file system to Hadoop file system b. Performing MAP Reduction operation in Hadoop c. Verification of operation results through terminal and browser	9	CO6

Text Books:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2016
2. Chris Eaton,Dirk derooset al. , “Understanding Big data ”, McGraw Hill, 2016.
3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2015.
4. Efraim Turban , Jay E. Aronson , Ting-Peng Liang, “Decision Support Systems & Intelligent Systems”, 9th edition, Prentice Hall, 2014.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	CIE	Assignments	Hands on Laboratory Experiments
Marks	**25**	**10**	**15**
Remember	5	-	-
Understand	5	5	5
Apply	10	5	10
Analyze	5	-	-
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	-
Understand	10
Apply	30
Analyze	5
Evaluate	-
Create	5

OPTICAL FIBER COMMUNICATION			
Course Code	**: ECE564**	**Credits**	**:04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**: 3**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Describe the basic fundamentals of optical fiber communication
CO2	Construct the structures of Optical fiber and types
CO3	Examine the contribution of channel impairments like attenuation and dispersion in optical signal transmission
CO4	Categorize the Optical sources and detectors based on their performance
CO5	Evaluate the link power budget for design of fiber optic systems
CO6	Analyze the principle of WDM highlighting its applications in optical networks

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	1	-	-	-	-	-	-	-	-	3	3
CO6	3	3	3	-	-	-	-	-	-	-	-	-	3	3

Module No	Module Contents	Hrs.	COs
1	**OVERVIEW OF OPTICAL FIBER COMMUNICATION:** Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cutoff wave length and mode filed diameter. Optical sources: LED's,, LASER diodes,	09	CO1 CO2
2	**TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS:** Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion Intra model dispersion, Inter model dispersion.	09	CO3
3	**OPTICAL RECEIVER:** Introduction, Photo detectors: PIN and APD, Photo detector noise. Optical Receiver Operation, receiver sensitivity, quantum limit, eye diagrams, coherent detection, Optical amplifiers, basic applications and types, Semiconductor optical amplifiers, EDFA.	09	CO4
4	**ANALOG AND DIGITAL LINKS:** Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber, key link parameters, Radio over fiber links, microwave photonics. Digital links – Introduction, point–to–point links, System considerations, linkpower budget, resistive budget, short wave length band, transmission distance for single mode fibers, Power penalties, nodal noise and chirping.	09	CO5

5	**WDM CONCEPTS AND COMPONENTS:** WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, couplers, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.	09	CO6

Text Books:

1. Optical Fiber Communication, Gerd Keiser, 4th Ed., MGH,2008.
2. Optical Fiber Communications, John M. Senior, PearsonEducation. 3rd Impression, 2007.

Reference books:

1. Fiber Optic Communication - Joseph C Palais: 4th Edition, Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Self - Study**
Marks	**20**	**10**	**10**	**10**
Remember	10	-	5	-
Understand	10	5	-	-
Apply	-	5	-	5
Analyze	-	-	5	5
Evaluate	-	-	-	-
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	**Tests**
Marks	**50**
Remember	15
Understand	15
Apply	15
Analyze	5
Evaluate	-
Create	-

New Horizon College of Engineering, Bangalore

B.E. Program - Batch: 2015 -2019

Department of Electronics and Communication Engineering

Academic Year: 2017 – 2018

Syllabus of Sixth Semester

Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	ECE61	Digital Communication	3	2	0	0	5	3	4	75	75	150
2	ECE62	Embedded System Design	3	2	0	0	5	3	4	75	75	150
3	ECE63	Microelectronic Circuits	4	0	0	0	4	4	0	50	50	100
4	ECE64	Microwaves and Radar	4	0	0	0	4	4	0	50	50	100
5	ECE65X	Professional Elective – II	3	0	0	1	4	3	0	50	50	100
6	NHOPXX	Open Elective – I	3	0	0	1	4	3	0	50	50	100
		TOTAL					**26**	**20**	**8**	**350**	**350**	**700**

Professional Elective – II (GROUP 2)

ECE651: Routing and Switching
ECE652: Digital Switching Systems
ECE653: Real Time Operating Systems
ECE654: Object Oriented Programming
ECE655: Image Processing
ECE656: Analog and Mixed mode VLSI Design

Open Elective – I

NHOP01: Big Data Analytics using HP Vertica - 1
NHOP02: VM Ware virtualization Essentials - 1
NHOP03: Adobe Experience manager - 1
NHOP07: SAP
NHOP08: Schneider - Industry Automation
NHOP09: Cisco - Routing & Switching – 1
NHOP10: Data Analytics
NHOP11: Machine Learning
NHOP13: Industrial IoT - Embedded Systems
NHOP14: Block chain
NHOP15: Product Life Cycle Management

DIGITAL COMMUNICATION			
Course Code	**:ECE61**	**Credits**	**:05**
L: P: T: S	**:3:2:0:0**	**CIE Marks**	**:50+25**
Exam Hours	**:03+03**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Apply the fundamentals of digital Communication for baseband signal processing and coding
CO2	Analyze the pulse shaping mechanism for distortion less base-band binary transmission
CO3	Categorize digital modulation techniques based on Bit Error Rate performance
CO4	Compare the access technologies available for multiuser communication in single-bandwidth
CO5	Estimate the signal in presence of noise by appropriate receiver design
CO6	Demonstrate the concepts of Digital communication and its applications

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO5	3	3	3	2	2	1	-	-	-	-	-	-	3	2
CO6	3	-	-	-	-	-	-	-	2	2	-	2	3	-

Module No	Module Contents	Hrs.	Cos
1	**Basic signal processing operations in digital communication:** Elements of a digital communication system, Sampling Theorem - Mathematical proof of sampling and reconstruction –ideal and Flat top sampling, Bandpass sampling ,quantization, Robust quantization-companding, Pulse code modulation, generation and detection of PCM, differential PCM; Delta modulation, Adaptive delta modulation, TDM-PCM, T1digital Hierarchy.	9	CO1 CO4
	LIST OF EXPERIMENTS: 1. TDM of two band limited signals. 2. PCM generation and detection using a CODEC Chip	6	
2	**Pulse Shaping for Data Transmission**: Discrete PAM signals, power spectra of discrete PAM signals, Derivation of power spectral density for NRZ unipolar format (other types expressions only), ISI, Nyquist's criterion for distortion less base-band binary transmission, eye pattern, Adaptive Equalization.	9	CO2 CO4

	LIST OF EXPERIMENTS: 1. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture. 2. Analog and Digital (with TDM) communication link using optical fiber.	6	
3	**Digital Modulation Techniques:** Digital Modulation formats, Coherent binary modulation techniques- Binary ASK, PSK, FSK, Coherent quadrature modulation techniques-QPSK, MSK. Non-coherent binary modulation techniques- DPSK , M-ary signaling schemes-M-ary PSK, M-ary QAM. Generation, detection, Signal space constellation, Performance, probability of bit error computation for all the modulation schemes, Comparison of Modulation techniques.	9	CO1 CO3 CO4
	LIST OF EXPERIMENTS: 1. ASK and FSK generation and detection 2. PSK generation and detection 3. DPSK generation and detection 4. QPSK generation and detection	6	
4	**Detection and estimation**: Gram-Schmidt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlator's to noisy input. Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.	9	CO1 CO4 CO5
	LIST OF EXPERIMENTS: 1. Measurement of frequency, guide wavelength, Power, VSWR and attenuation in a microwave test bench. 2. Measurement of directivity and gain of antennas: Standard dipole (or printed dipole), microstrip patch antenna and Yagi antenna (printed).	6	
5	**Spread Spectrum Techniques & Multiple Access Techniques:** Generation of PN Sequence and its properties – Direct Sequence Spread Spectrum – Processing Gain – Probability of Error – Anti jam Characteristics – Frequency Hopped Spread Spectrum – Slow and Fast frequency hopping–multiple access techniques TDMA, FDMA, CDMA	9	CO4 CO6
	LIST OF EXPERIMENTS: 1. Determination of coupling and isolation characteristics of a strip line (or microstrip) directional coupler. 2. Measurement of resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate. 3. Measurement of power division and isolation characteristics of a micro strip 3 dB power divider.	6	

Text Books:

1. Digital Communications, Simon Haykin, 2014, John Wiley.

2. Digital Communication, John G. Proakis, 5th Edition, 2014, Pearson Education.

Reference Books:

1. Digital Communications: Fundamentals and Applications, Bernard Sklar, 2016, Prentice Hall Publications.

2. Principles of Communication Systems, Herbert Taub and Donald L Schilling, 3rd Edition, 2012, Tata McGraw Hill.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	10	-	-	-
Apply	5	5	5	5
Analyze	5	5	-	-
Evaluate	-	-	-	5
Create	-	-	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	5	5
Apply	10	-
Analyze	-	-
Evaluate	-	-
Create	-	-

Note: Numericals on PCM-TDM systems and probability of error computations relevant to various modulation schemes have to be given as an assignment during the semester, and has to be evaluated for 5 marks, under "Apply" category.

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	15
Apply	10
Analyze	10
Evaluate	5
Create	-

Practical (25 Marks)

Bloom's Taxonomy	Tests
Marks	**25**
Remember	5
Understand	10
Apply	10
Analyze	-
Evaluate	-
Create	-

EMBEDDED SYSTEM DESIGN			
Course Code	**:ECE62**	**Credits**	**:05**
L: P: T: S	**:3:2:0:0**	**CIE Marks**	**:50+25**
Exam Hours	**:03+03**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Choose system core, memory, communication and I/O interfaces to develop embedded applications
CO2	Identify the characteristics and quality attributes of embedded system
CO3	Appraise the architecture, programmers model and features of ARM Cortex M processor
CO4	Demonstrate experiments on developing embedded system
CO5	Analyze codes in assembly and high level for given applications using embedded software development suites
CO6	Select computational models in embedded design and engage in self learning by analyzing and carrying out embedded projects

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	3	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	3	-	-	-	3	3
CO4	3	3	3	2	3	-	-	-	3	-	-	3	3	3
CO5	3	3	3	-	3	-	-	-	3	-	-	3	3	3
CO6	3	3	3	2	3	-	-	-	3	1	-	3	-	3

Module No	Module Contents	Hrs.	COs
1	**Introduction to Embedded Systems :**What is an Embedded System, Embedded Systems Vs General Computing Systems, Classification of Embedded System, Major Application areas of Embedded System, Purpose of Embedded System, The Innovative Bonding of lifestyle with Embedded Technology.	9	CO1 CO5
	LIST OF EXPERIMENTS: 1.Study of ARM- Cortex M4 processor development board. 2.Write Assembly language programs involving Memory accessing instructions.	6	
2	**Typical Embedded System**: Core of the Embedded System, Sensors and Actuators, Memory,Communication Interface, Embedded Firmware, Other System Components **Characteristics and Quality Attributes of Embedded Systems**:Characteristicsofanembeddedsystem,qualityattributesofembedded system.	9	CO1 CO2 CO5
	LIST OF EXPERIMENTS: 1. Write Assembly language programs involving i) General data processing instructions. ii) Multiply and Divide instructions.	6	

3	**Introduction to ARM Cortex M Processors:** What are ARM Cortex M Processors, Advantages and Applications of Cortex M Processors. **Introduction to Embedded Software Development**: Software Development flow, Compiling the applications, software flow, Input, output and peripheral accesses, Microcontroller interfaces	9	CO3 CO4 CO5
	LIST OF EXPERIMENTS: 1. Write Assembly language programs involving i)packing and unpacking instructions ii)Bit field instructions iii)Floating point instructions	6	
4	**ARM- 32 bit Microcontroller family: Cortex M4 Basics** Architecture of ARM Cortex-M4, Operation modes and states, Registers, Special Registers, Data type, Memory format, Instruction Set Summary.	9	CO3 CO4 CO5
	LIST OF EXPERIMENTS: 1. Write C programs to demonstrate serial communication using ARM Cortex M4i) "Welcome to ECE" message using UART ii) blinking LEDs	6	
5	**Hardware Software Co-Design and Program Modeling:** Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs.	9	CO4 CO5 CO6
	LIST OF EXPERIMENTS: 1. Demonstrate Interrupt operations using C program i)Timer ii)Stop watch	6	

Note:

1) Programming to be done using Keiluvision 4 and download the program on to a M4 evaluation board such as STM32F nucleo boards,Tiva C Series board.

2) Experiments from 1 to 4 should include atleast 4 programs each.

Text Books:

1. Introduction to Embedded Systems, Shibu K V, 2009,TMH.

2. TheDefinitiveGuidetoARMCortex–M3andCortex-M4ProcessorsJosephYiu,3rdEdition, 2014, Elsevier.

Reference Books:

1. Embedded Systems – A contemporary Design Tool, James K Peckol, 2014, John Wiley.

2. Cortex M4 Technical Reference Manual, ARM.

3. M4 Programming manual, ST microelectronics.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	5	-	-	-
Apply	10	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	**5**	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	5	5
Apply	10	-
Analyze	-	-
Evaluate	-	-
Create	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	15
Apply	15
Analyze	10
Evaluate	-
Create	

Practical (25 Marks)

Bloom's Taxonomy	Tests
Marks	**25**
Remember	10
Understand	5
Apply	10
Analyze	-
Evaluate	-
Create	-

MICROELECTRONICS CIRCUITS			
Course Code	**:ECE63**	**Credits**	**:04**
L: P: T: S	**: 4:0:0:0**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Analyze the biasing techniques for the operation of MOSFET
CO2	Use small signal models for MOSFET configurations
CO3	Design CS amplifier configuration for real time applications and societal requirements
CO4	Determine the gain and bandwidth of MOS amplifier circuits using high frequency response
CO5	Evaluate the performance of current mirror circuits in MOS amplifier
CO6	Appraise the differential pair configuration in transistor pair to achieve the target specifications

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	3	3	-	-	-	-	3	3	-
CO4	3	3	3	2	-	3	3	-	-	-	-	3	3	-
CO5	3	3	3	-	-	3	3	-	-	-	-	3	3	-
CO6	3	3	3	-	-	3	3	-	-	-	-	3	3	1

Module No	Module Contents	Hrs.	COs
1	**Biasing in MOS amplifier circuits:** Biasing by fixing VGS, Biasing by fixing VG and connecting a resistor in the source, Biasing using a drain to gate feedback resistor, biasing using a constant-current source, MOSFET circuits atDC.**MOSFETasanamplifierandswitch**:Graphicalderivationofthetransfer characteristic, operation as a switch, operation as a linear amplifier. Numerical Examples.	9	CO1
2	**Small – signal operation and models of MOSFETs** The DC bias point, the signal current in the drain terminal , the voltage gain, separating dc analysis and the signal analysis, small signal equivalent circuit models, the Transconductance (gm), the T Equivalent- Circuit model, Modeling the body effect and channel length modulation. **Single stage MOS amplifiers** The CS amplifier, The CS amplifier with a source resistance, Common gate amplifier, Common drain or Source-follower amplifier, Numerical.	9	CO2 CO3
3	**Single stage IC amplifiers** **IC Biasing -** The basic MOSFET current source, current mirror, MOS current steering circuits. **High Frequency Response-General Considerations**: High frequency gainfunction,Determiningthe3-dBfrequencyusingopencircuittime constants,CMOSImplementationofCSAmplifier,HighfrequencyresponseofCS amplifier, CG and CD amplifiers with active loads, High frequency response of CG and CD amplifiers.	9	CO2 CO4 CO5

4	**The Cascode amplifier**: The MOS Cascode, Frequency response of MOS Cascode, A Cascode Current source, Double cascoding, The Folded cascode, BiCMOSCascode.**Current Mirror Circuits with Improved Performance**: Cascode MOS Mirrors, Bipolar mirror with Base-current Compensation, The Wilson Current Mirror, The Wilson MOS Mirror, The Widlar Current source.	9	CO2 CO4 CO5
5	**Differential Amplifiers:** The MOS Differential Pair, Small Signal Operation of the MOS Differential Pair. **Transistor Pairings**: The CD-CS, CC-CE and CD-CE Configurations, The Darlington Configurations, The CC-CB and CD-CG Configurations.	9	CO2 CO6

Text Books:

1. Microelectronic Circuits - Theory and applications, Adel S. Sedra and Kenneth C. Smith, 5thEdition, 2015, Oxford International version.

Reference Books:

1. FundamentalsofMicroelectronics,BehzadRazavi,2008, JohnWileyIndiaPvt.Ltd.
2. Microelectronics- Analysis and Design, Sundaram Natarajan, 2007, Tata McGraw-Hill.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	5	-	5	-
Apply	5	5	-	5
Analyze	5	5	-	-
Evaluate	-	-	-	5
Create	5	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	5
Create	5

MICROWAVES AND RADAR			
Course Code	**:ECE64**	**Credits**	**:04**
L: P: T: S	**: 4:0:0:0**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Solve the transmission line problems using analytical and graphical approach
CO2	Apply the knowledge of low frequency network to express Scattering parameter for impedance matching
CO3	Analyze the working principle of microwave multiport junctions
CO4	Categorize the radiation effects associated with RF sources
CO5	Analyze the behavior and characteristics of microwave active components
CO6	Select RADAR systems for the prediction of stationary and non stationary targets

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	3	-	2	1	-	1	-	-	2	-	2
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO6	3	3	3	3	-	2	-	-	-	-	-	2	3	2

Module No	Module Contents	Hrs.	COs
1	**Fundamentals of Microwave and Transmission Lines:** Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs. Introduction to strip lines(qualitative analysis only).	9	CO1
2	**Microwave Network Theory :** Introduction, Symmetrical Z and Y parameters for reciprocal Networks, S matrix representation of multi- port networks, Properties of S parameters, S – parameters of a Two – port network with mismatched load, Comparison between [S], [Z], and [Y] matrices, Relations of Z, Y, ABCD parameters with S-Parameters.	9	CO2
3	**Microwave Passive Devices:** Introduction, Coaxial cables, connectors and adapters, Wave guide sections, matched terminations, Coaxial line to waveguide adapters, Attenuators, Phase shifters, Waveguide Tees, Magic tees, circulators and isolators, directional couplers-Bethe-hole coupler.	9	CO2 CO3
4	**Microwave Active Devices and Diodes:** Introduction, Schottky diode, PIN diode, Transfer electron devices – GUNN effect diodes, Avalanche transit time devices-READ diodes, IMPATT Diodes, TRAPATT Diodes, BARITT Diodes.	9	CO4 CO5

5	**RADAR AND ITS APPLICATIONS:** Basic Radar, Radar frequencies, The simple form of the Radar equation, Radar block diagram. Introduction to Doppler and MTI Radar, delay line Cancellers, digital MTI processing, Moving target detector, Pulse Doppler Radar, application of Radar.	9	CO6

Text Books:

1. Microwave Engineering, Annapurna Das, SisirK Das,2001,TMH.
2. IntroductiontoRadarsystems,MerrillISkolnik,3rdedition,2001,TMH.
3. Microwave Devices and circuits, Liao, Pearson Education.

Reference Books:

1. MicrowaveEngineering,DavidMPozar,2ndedition,2004,JohnWiley.
2. MicrowaveEngineering,ConceptsandFundamentals,AhmadShahidKhan,2014, CRC Press, Tayor and FrancisGroup.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-Curricular activities
Marks	**25**	**10**	**5**	**10**
Remember	5	-	-	-
Understand	10	5	-	-
Apply	5	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

ROUTING AND SWITCHING			
Course Code	**:ECE651**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50+25**
Exam Hours	**:03**	**SEE Marks**	**:50+25**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Identify the devices and services used to support communications in data networks, Internet and Role of Protocol in Network
CO2	Analyze the Physical Layer, Data Link layer, Network layer and Transport Layer Devices and Protocol in real networking scenario
CO3	Troubleshoot basic networking operations on routers and switches
CO4	Design subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 network
CO5	Configure and troubleshoot the operations of Static and Dynamic Routing
CO6	Evaluate a simple Ethernet network using routers and switches

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	3	-	-	-	-	3	-
CO3	3	3	3	3	3	-	-	-	3	-	-	3	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	-	-	-	3	-	-	3	3	3
CO6	3	3	3	3	3	-	-	-	3	-	-	3	3	3

Module No	Module Contents	Hrs.	COs
1	**Exploring the Network**: Globally Connected Communicating in a Network-Centric World, LANs, WANs, and the Internet The Network as a Platform, The Changing Network Environment, and The Expanding Network Configuring a Network Operating System. **Configuring a Network Operating System:** IOS Boot camp, Getting Basic Addressing Schemes. **Network Protocols and Communications**: Rules of Communications, Network Protocols and Standards, Using Requests for Comments, Moving Data in the Network. **Hands On :** Introduction to Packet Tracer Navigating the IOS Configuring Initial Switch Settings Basic Device Configuration Investigating OSI and TCP/IP Model	9	CO1
2	**Network Access**: Physical Layer Protocols, Network Media, Data Link Layer Protocols, Media Access Control. Ethernet, Ethernet Protocol Address Resolution Protocol, LAN Switches, Basic Switch Configuration, Switch Security: Management and Implementation **Hands On :** Identify MAC and IP Address	9	CO2 CO3 CO6

	Examine the ARP Table Basic Switch Configuration Configuring SVI Switch Port Security		
3	**Network and Transport Layer** **Network Layer**: Network Layer Protocols, Routing ,Routers ,Configuring a Cisco Router ,**Transport Layer**: Transport Layer Protocols, TCP and UDP, Initial Configuration of a Router, Routing Decisions, Link Aggregation Concepts, Router Operation **Hands On :** Configure Initial Router Settings Connect a Router to a LAN Troubleshoot Default Gateway Issues Investigate Unicast, Broadcast and Multicast Traffic Exploring TCP and UDP Communication	9	CO2 CO3 CO6
4	**IP Addressing (IPv4 and IPv6)** IP Addressing, IPv4 Network Addresses, IPv6 Network Addresses, Connectivity Verification, Subnetting IP Networks, Subnetting an IPv4 Network, Addressing Schemes, Design Considerations for IPv6,and Review of CIDR,VLSM **Hand On:** Configure IPv4 Addressing Configure IPv6 Addressing Manually Configure LLA Manually Configure Global Unicast Address Manually & Auto-Config mode Verifying IPv4 and IPv6 Addressing Troubleshooting IPv4 and IPv6 Addressing Subnetting Scenario for IPv4 Implementing Subnetted IPv6 Addressing Schemes	9	CO4 CO5 CO6
5	**Application layer** Application Layer Protocols ,Well-Known Application Layer Protocols and Services, The Message Heard Around The World, Create and Grow Network, Keeping the Network Safe ,Basic Network Performance Managing IOS Configuration Files,Static Routing ,Static Routing Implementation, Configure Static and Default Routes, Configure Summary and Floating Static Routes, Troubleshoot Static and Default Route issues, Integrated Routing Services, Routing Dynamically, Dynamic Routing Protocols, RIP and RIPng Routing **Hands On :** Configuring Secure Password and SSH Using Show Commands Configure Records on DNS Server Configure Static Route and Default Route Troubleshoot Static Route and Default Route Configure Summary Route and Floating Route	9	CO3 CO5 CO6

TEXT BOOKS:

1. CCNA Routing and Switching – Todd Lammle, 2nd Edition, Sybex Publisher

REFERENCE BOOKS:

2. CCNA v2.0 R&S Lab Workbook 200-120.
3. CISCO CCNA Routing and Switching , CISCO Press ,ICND2 200-101
4. Computer Networks, Andrew S. Tanenbaum, Fourth Edition Pearson Education
5. Data Communications and Networking, Behrouz.A.Forouzan, Tata McGraw Hill, 4th Edition

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	PT Activity	Quizzes
Marks	**20**	**20**	**10**
Remember	10	-	5
Understand	10	-	-
Apply	-	10	-
Analyze	-	5	5
Evaluate	-	-	-
Create	-	5	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	5
Understand	5
Apply	20
Analyze	10
Evaluate	-
Create	10

DIGITAL SWITCHING SYSTEMS			
Course Code	**:ECE652**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Understand the basic concepts of telecommunications
CO2	Categorize the types of switching systems
CO3	Demonstrate the model of digital switching system
CO4	Evaluate the telecommunications traffic model considering societal cause
CO5	Examine the methods of grading and Time Division switching
CO6	Analyze the software aspects of switching system

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-		-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	1	-	1	-	-	3	3	3
CO4	3	3	3	3	1	1	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO6	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Module No	Module Contents	Hrs.	COs
1	**Introduction:** Developments of telecommunications, Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM, PDH and SDH, Transmission performance. **Evolution of switching systems:** Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems, Basics of crossbar systems, Electronic switching, Digital switching systems.	9	CO1 CO2
2	**Digital switching systems:** Fundamentals, Purpose of analysis, Basic central office linkages, Outside plant versus inside plant, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, Basic call processing. **A Generic Digital switching system Model:** Introduction, Scope, Hardware architecture, Software architecture, Recovery strategy, Simple call through a digital system, Common characteristics of digital switching systems.	9	CO3
3	**Telecommunications Traffic:** Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, lost call systems, Queuing systems.	9	CO4

4	**Switching Systems:** Introduction, Single stage networks, Gradings, Link Systems, GOS of Linked systems. **Time Division Switching:** Introduction, space and time switching, Time switching networks, Synchronization.	9	CO5
5	**Switching system software:** Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Digital switching system software classification, Call models, Connect sequence, Software linkages during call, Call features, Feature flow diagram, Feature interaction.	9	CO6

Text Books:

1. TelecommunicationandSwitching, TrafficandNetworks, JEFlood, 2002,Pearson Education.
2. Digital Switching Systems, Syed R. Ali, 2002,TMH.

Reference Books:

1. Digital Telephony, John C Bellamy, 3rd edition, 2008, Wiley India India Pvt. Ltd.
2. Telecommunication Switching Systems And Networks, Thyagarajan Viswanathan, 1992, PHI Learning.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Self - Study
Marks	**20**	**10**	**10**	**10**
Remember	5	-	-	-
Understand	5	-	5	-
Apply	5	5	-	5
Analyze	5	-	5	5
Evaluate	-	5	-	-
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	-

REAL TIME OPERATING SYSTEMS			
Course Code	**:ECE653**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Understand the basic concepts of Operating System
CO2	Apply concepts of operating system in Real Time Systems
CO3	Analyze real-time Operating System requirements and design issues
CO4	Evaluate the design patterns and program structures of RTOS
CO5	Appraise interaction between multiple tasks in exploiting concurrency
CO6	Evaluate common design problems and value the solutions

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	3	-	-	-	-	-	3	3	3
CO4	3	3	3	-	-	-	-	-	3	-	-	3	3	3
CO5	3	3	3	-	-	3	-	-	3	-	-	3	3	3
CO6	3	3	3	1	-	3	-	-	3	-	-	3	3	3

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Module No	Module Contents	Hrs.	COs
1	**Review of Operating Systems:** What operating systems do, Operating System Structure, Operating-System Operations, Process Management Memory Management, Storage Management, Protection and Security **Review of Real Time Embedded Systems:** Real- Time Systems, Characteristics of Real Time Systems, Hard and Soft Real Tim Systems. Case study: Practical Real Time System	9	CO1 CO2
2	**Introduction to Real-Time Operating Systems**: A Brief History of Operating Systems, Defining an RTOS, The Scheduler, Objects, Services, Key Characteristics of an RTOS. **Tasks:** Defining a Task, Task States and Scheduling, Typical Task Operations, Typical Task Structure, Synchronization, Communication, and Concurrency.	9	CO1 CO2 CO3
3	**Real Time Kernel Objects**: Semaphores: Defining Semaphores, Typical Semaphore Operations, Typical Semaphore Use. Message queues: Defining Message Queues, Message Queue States, Message Queue Content, Message Queue Storage, Typical Message Queue Operations, Typical Message Queue Use.	9	CO4 CO5
4	**RTOS Design Considerations:** I/O sub system: Basic I/O Concepts, The I/O Sub system. Memory Management: Dynamic Memory Allocation, Fixed-Size Memory Management, Blocking vs. Non-Blocking Memory Functions, Hardware Memory Management Units	9	CO4

5	**Tasks Communication and Synchronization:** Synchronization, Communication, Resource Synchronization Methods, Common Practical Design Patterns.**Common Design Problems**: Resource Classification, Deadlocks, Priority inversion. Case study: Features of commercial RTOS :MicroC/OS-II and VxWorks	9	CO5 CO6

Text Books:

1. Operating System Concepts , Abraham Silberschatz, Peter Baer Galvin, Burlington, Greg Gagne, 9th edition, 2012, Wiley Global Education.
2. Real-Time Concepts for Embedded Systems, Qing Li with Caroline Yao, 2011, CMP Books.

Reference Books:

1. Real-TimeSystems, JaneW.S.Liu, 8thImpression,2009,PearsonEducation.
2. Real-TimeSystemsDesignandAnalysis,PhilipA.Laplante,3rdedition,2004, Wiley Student Edition.
3. Real-Time Systems, C.M. Krishna, Kang G. Shin, 2010, Tata McGraw-Hill.
4. IntroductiontoEmbeddedSystems, ShibuKV, 2010, TataMcGrawHill.

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Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	**Tests**	**Assignments**	**Quizzes**	**Self - Study**
Marks	**20**	**10**	**10**	**10**
Remember	5	-	-	-
Understand	5	-	5	-
Apply	5	5	-	-
Analyze	5	-	-	5
Evaluate	-	-	5	5
Create	-	5	-	-

Note: Task creation/deletion/addition to be given as an assignment during the semester, and has to be evaluated for 5 marks, under "Create" category.

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	**Tests**
Marks	50
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	-

OBJECT ORIENTED PROGRAMMING			
Course Code	**:ECE654**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Distinguish between structure oriented programming and object oriented programming
CO2	Analyze functions to improve the code modularity and reusability
CO3	Apply the concepts of objects, classes and inheritance in object oriented programming
CO4	Examine the programs on operator-overloading technique
CO5	Choose the exception handling techniques in real time programming
CO6	Engage students for life long learning and work on multidisciplinary projects

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	3	-	3
CO6	3	3	3	2	1	-	-	-	1	1	1	3	1	3

Module No	Module Contents	Hrs.	COs
1	**Introduction:** Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types.	9	CO1
2	**Functions:** Introduction, Function definition and its prototype, function with empty parameter list, inline function, references and reference parameters, default arguments, function overloading and templates, recursion.	9	CO1 CO2
3	**Introduction to class:** Defining a class with member function, defining a member function with a parameter, data members, set and get member function, initializing objects with constructor, time class case study, class scope and assessing class members, access and utility functions, constructor with default arguments, destructor, when constructors and destructor are called, Time class case study, default member wise assignment, const objects and const member functions, friend function and friend class using this pointer.	9	CO1 CO2 CO3 CO6
4	**Operator Overloading:** Introduction and Fundamentals of overloading, overloading of binary and unary operators, overloading of prefix and post fix operators, Dynamic memory management. **Exception Handling:** Introduction, Example: Handling an attempt to divide by zero, rethrowing an exception, stack unwinding, when to use exception handling, constructor, destructor and exception handling, exception and inheritance.	9	CO1 CO4 CO5 CO6

5	**Inheritance:** Introduction, Base-Class Access Control, Inheritance and protected Members, Inheriting Multiple Base Classes, Constructors, Destructors, and Inheritance	9	CO1 CO2 CO3 CO6

Text Books:

1. C++ - How to program, Paul deitel and Harvey deitel, 9th Edition, 2014, Pearson.
2. TheCompleteReferenceC++,HerbertSchildt,4th Edition,2003,TataMcGrawHill.

Reference Books:

1. C++ Primer, Stanley B. Lippman, JoséeLajoie, Barbara E. Moo, 5th Edition, 2012, Addison Wesley.
2. The C++ programming language, Bjarne Stroustrup, 4th Edition, 2013, Pearson.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Self - Study
Marks	**20**	**10**	**10**	**10**
Remember	5	-	5	-
Understand	5	-	-	5
Apply	10	10	5	-
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	5

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	**50**
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

IMAGE PROCESSING			
Course Code	**:ECE655**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	State the various steps and components of a general purpose image processing system
CO2	Explain the various types of image acquisition techniques and representation of image
CO3	Demonstrate the various mathematical transforms that are required to be applied for processing the image
CO4	Compare different spatial and frequency domain image enhancement algorithms
CO5	Appraise 2-D filtering and image restoration techniques
CO6	Design different segmentation techniques

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO6	3	3	3	3	-	-	-	-	-	-	-	-	3	3

Module No	Module Contents	Hrs.	COs
1	**Introduction and Fundamentals :** Definition and origins of Digital Image Processing, Fundamentals steps involved in digital image processing, Components of an Image Processing System, Elements of visual perception, Image Sensing and acquisition, Image sampling and quantization, Basic relationship between pixels, Linear and nonlinear operators.	9	CO1 CO2
2	**Image Transforms:** Two dimensional Orthogonal and unitary Transforms, Properties of Unitary Transforms, 1D-DFT,2D-DFT, DCT, DST, Hadamard Transform.	9	CO3
3	**Image Enhancement :** Image Enhancement in Spatial domain - Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations. Basics of spatial filtering, smoothing and sharpening spatial filters, combining spatial enhancement methods, Frequency–domain enhancement–smoothing and sharpening frequency – domain filters, Homomorphic filtering.	9	CO4
4	**Image Restoration:** A model of the image degradation/restoration process, Noise models, Restoration in the presence of noise only-spatial filtering, periodic noise reduction by frequency domain filtering, linear, positioninvariantdegradations,estimationofthedegradationfunction,inverse filtering, MMSE (Wiener) Filtering.	9	CO5

5	**Image Segmentation:** Detection of Discontinuities, Edge linking and boundary detection, thresholding, Region-based segmentation, Segmentation by morphological watersheds.	9	CO6

Text Books:

1. Digital Image Processing, R C. Gonzalez, R. E. Woods, 3rd Edition, 2015, Pearson Education India.
2. Fundamentals of Digital Image Processing, Anil K. Jain, 1st Edition, 2014, Pearson Education India.

Reference Books:

1. DigitalImageProcessingandAnalysis,B.ChandaandD.Majumdar,1stEdition,2014, PHI Learning Private Limited.
2. Digital Image Processing, Madhuri Joshi, 1st Edition, 2015, PHI Learning Private Limited.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Self - Study
Marks	**20**	**10**	**10**	**10**
Remember	5	5	-	-
Understand	5	5	5	-
Apply	5	-	5	5
Analyze	5	-	-	5
Evaluate	-	-	-	-
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks	50
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	-
Create	-

ANALOG AND MIXED MODE VLSI DESIGN			
Course Code	**:ECE656**	**Credits**	**:04**
L: P: T: S	**:3:0:0:1**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the student will have the ability to:

CO1	Recall the basics of Analog-to-Digital Conversion and vice versa
CO2	Discuss the different architectures of ADCs and DACs
CO3	Evaluate the process changes for the submicron layout
CO4	Employ the designs of resistors and capacitors for the submicron processes
CO5	Employ the op-amp design criteria for the submicron dimensions
CO6	Illustrate the design steps of non-linear analog circuits

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	3	3	-	3	-	-
CO2	3	3	3	3	3	2	3	1	3	3	3	3	3	-
CO3	3	3	3	3	3	-	-	-	3	3	-	3	3	2
CO4	3	3	3	3	3	-	3	1	3	3	3	3	3	2
CO5	3	3	3	3	3	-	-	-	3	3	3	3	3	2
CO6	3	3	3	3	3	-	-	1	3	3	-	3	3	2

Module No	Module Contents	Hrs.	COs
1	**Data converter fundamentals:** Analog versus Digital Discrete Time Signals, Converting Analog Signals to Data Signals, Sample and Hold Characteristics, DAC Specifications, ADC Specifications, Mixed-Signal Layout Issues.	9	CO1
2	**Data Converters Architectures:** DAC Architectures, Digital Input Code, Resistors String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC.	9	CO2
3	ADC Architectures, Flash ADC, 2-Step Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC.	9	CO2
4	**Sub-Micron CMOS circuit design:** Process Flow, Capacitors and Resistors, MOSFET Switch, Delay and adder Elements, Analog Circuits MOSFET Biasing, OP-Amp Design.	9	CO3 CO4 CO5
5	**Non-Linear Analog Circuits**: Basic CMOS Comparator Design, Analog Multipliers, Multiplying Quad, Level Shifting.	9	CO6

Text Books:

1. Design,Layout,Simulation,R.JacobBaker,HarryWLi,DavidEBoyce,PHIEducation, 2005.
2. CMOS- MixedSignalCircuitDesign,R.JacobBaker,JohnWileyIndiaPvt.Ltd,2008.

Reference Books:

1. Design of Analog CMOS Integrated Circuits, BRazavi,FirstEdition,McGrawHill,2001.
2. CMOS Analog Circuit Design, PEAllen and DRHolberg,2nd Edition, OxfordUniversityPress,2002.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Self - Study
Marks	**20**	**10**	**10**	**10**
Remember	5	-	5	-
Understand	5	5	-	5
Apply	10	-	5	-
Analyze	-	5	-	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
MarECs	**50**
Remember	10
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	-

APPENDIX A

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

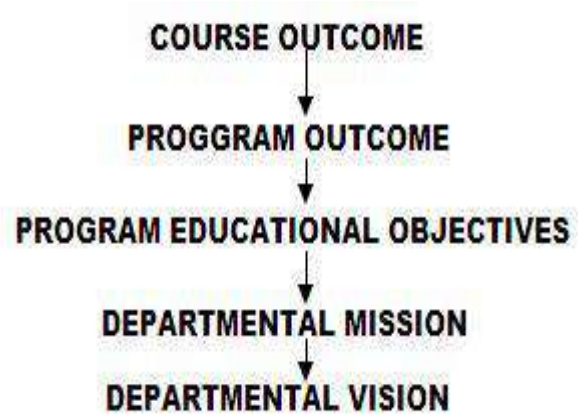
There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX B

The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved bystraight forward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

The engineer and society: 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.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with theengineering 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.

Project management and finance: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognise the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.