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 2018-19

ECE - Electronics & Communication Engineering

Third and Fourth 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: 2017 -2021

Department of Electronics and Communication Engineering

Scheme of Third and Fourth Semester

Second Year / Third Semester												
Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	MAT31	Engineering Mathematics - III	4	0	1	0	5	6	0	50	50	100
	HSS322	Life Skills for Engineers	2	0	0	1	3	2	0	50	50	100
3	ECE33	Digital Electronic Circuits	3	2	0	0	5	3	4	75	75	150
4	ECE34	Analog Electronic Circuits	3	2	0	0	5	3	4	75	75	150
5	ECE35	Network Analysis	3	0	1	0	4	5	0	50	50	100
6	ECE36	Signals and Systems	3	0	0	0	3	4	0	50	50	100
7	ECE37	Mini project - 1	0	2	0	0	2	0	0	25	25	50
TOTAL							27	23	8	375	375	750

Second Year / Fourth Semester												
Sl. No.	Course code	Course title	Credit Distribution				Overall credits	Theory hours	Lab hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	MAT41	Engineering Mathematics-IV	4	0	1	0	5	6	0	50	50	100
2	HSS421	Economics for Engineers	2	0	0	1	3	2	0	50	50	100
3	ECE43	System Design using HDL	3	2	0	0	5	3	4	75	75	150
4	ECE44	Digital Signal Processing	3	2	0	0	5	3	4	75	75	150
5	ECE45	Control Systems	3	0	1	0	4	5	0	50	50	100
6	ECE46	Linear Integrated Circuits	3	0	0	0	3	4	0	50	50	100
7	ECE47	Mini Project-II	0	2	0	0	2	0	0	25	25	50
TOTAL							27	23	8	375	375	750

New Horizon College of Engineering, Bangalore

B.E. Program - Batch: 2017-2021

Department of Electronics and Communication Engineering

Academic Year: 2018 – 2019

Syllabus of Third Semester

Sl. No.	Course code	Course title	Credit Distribution				Overall Credits	Theory Hours	Lab Hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	MAT31	Engineering Mathematics - III	4	0	1	0	5	6	0	50	50	100
2	HSS321	Life Skills for Engineers	2	0	0	1	3	2	0	50	50	100
3	ECE33	Digital Electronic Circuits	3	2	0	0	5	3	4	75	75	150
4	ECE34	Analog Electronic Circuits	3	2	0	0	5	3	4	75	75	150
5	ECE35	Network Analysis	3	0	1	0	4	5	0	50	50	100
6	ECE36	Signals and Systems	3	0	0	0	3	4	0	50	50	100
7	ECE37	Mini project - 1	0	2	0	0	2	0	0	25	25	50
TOTAL							**27**	**23**	**8**	**375**	**375**	**750**

ENGINEERING MATHEMATICS – III			
Course Code	**: MAT31**	**Credits**	**:05**
L: P: T: S	**:4:0:1:0**	**CIE Marks**	**:50**
Exam Hours	**:03**	**SEE Marks**	**:50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Solve the Fourier series expansion of a functions analytically and numerically
CO2	Solve the Continuous model problems using Fourier transforms
CO3	Solve the discrete model problems using Z-transforms and Fast Fourier transform
CO4	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data
CO5	Use appropriate numerical methods to solve algebraic and transcendental equations and also Evaluate a definite integral numerically
CO6	Use appropriate numerical methods to solve Boundary Value Problems in Partial differential equations

Mapping of Course Outcomes to Program Outcomes:

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

Module No.	Contents of Module	Hrs	Co's
1	**Fourier series:** Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period $2l$, half range series. Fourier series and half Range Fourier series of periodic square wave, half wave rectifier, full wave rectifier, Saw-tooth wave with graphical representation, practical harmonic analysis.	**9**	CO1
2	**Fourier Transforms:** Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier transform. **Z - Transform**: Definition, Z-transforms of some standard functions , properties, damping rule, shifting rule(without proof), initial and final value theorems, inverse Z- transforms. **Applications:** Solving difference equations using Z-transform.	**9**	CO1 CO2

3	**Statistical Methods:** Fitting of the curves of the form $y = a + bx$, $y = a + bx + cx^2$, $y = ae^{bx}$, $y = ax^b$, and $y = ab^x$ by the method of least square**,** Correlation and Regression, Regression coefficients, line of regression – problems. **Discrete Fourier Transform and Fast Fourier Transform**: Definition of N-Point DFT, problems for 4-Points and inverse DFT for four points only. FFT algorithms to compute the Fourier transform 4-Point only.	**9**	CO3 C04
4	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations; Rugula- falsi method and Newton Raphson's method. Solution of a system of equations using Gauss-seidel and Relaxation method. Interpolation & extrapolation – Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals.	**9**	CO5
5	**Numerical Methods-2**: Numerical integration - Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule (without proof)-Problems. Numerical solution of Boundary value problems-Solution of one dimensional wave equation and heat equation, Numerical solution of two dimensional Laplace's equation and Poisson's equation.	**9**	CO5 CO6

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10^{th} edition, 2014, Wiley-India publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43rdedition, 2014, Khanna Publishers.

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4th edition, 2015, Pearson Education.
2. Advanced Engineering Mathematics, Dennis G. Zill, Michael R. Cullen, 4th edition, 2015, Jones and Barlett Publishers Inc.
3. Engineering Mathematics, B. V. Ramana, 4th edition, 2005, Tata McGraw Hill Publications.
4. Engineering Mathematics, Anthony Craft, 4th edition, 2013, Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	**30**	**10**	**5**
Remember	10	3	5
Understand	5	5	5
Apply	5	2	-
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

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

LIFE SKILLS FOR ENGINEERS			
Course Code	**:HSS322**	**Credits**	**:03**
L: P: T: S	**:2:0:0:1**	**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	To transform as stronger individuals to handle life challenges of professional life
CO2	To apply the concept of Personality development & Grooming in real life
CO3	Understand the concept of self and Creativity so that they can align with their life better
CO4	To understand the role of motivation and leadership on behavior
CO5	To enhance holistic development of personality to equip the student with employability skills
CO6	Determine the significance of goal setting & decision making in their professional life

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	3	2	3	3	3	3	2	3	3	3	-	-
CO2	2	3	3	2	3	3	3	3	2	3	3	3	-	-
CO3	2	3	3	2	3	3	3	3	2	3	3	3	-	-
CO4	2	3	3	2	3	3	3	3	2	3	3	3	-	-
CO5	2	3	3	2	3	3	3	3	2	3	3	3	-	-
CO6	2	3	3	2	3	3	3	3	2	3	3	3	-	-

Module No	Module Contents	Hrs.	Cos
1	**Personality development & Grooming:** Expectations from the industry & Career Planning / Reality Check; Building personal presence; Corporate grooming; Corporate etiquettes; Developing personal workcode.	6	CO1 CO5
2	**Self-Analysis & Creativity:** SWOC analysis, Who am I attributes, Importance of Self Confidence, Self-Awareness, Self-Management, Social Awareness, Emotional Intelligence, out of box thinking, lateral Thinking & Johari windows.	4	CO2 CO3
3	**Motivation & Leadership:** Basic concepts & theories, factor, types of Motivation, Good Leadership skill, Traits of a leader & Assessment of Leadership Skill.	4	CO4
4	**Interpersonal Skill:** Assessment of interpersonal skills, situation detail of interpersonal skill, Team Working, leading a team, and Strategies for influencing people. Understanding the relationship among motivation, leadership and teamwork	4	CO5
5	**Goal Setting and Decision Making:** identifying goals like (short term, long term, lifetime goals), Time management, importance of work scheduling, importance and necessity of decision making.	4	CO6

Text Books:

1. Soft Skill, 2015, Career development Centre, Green Pearl Publication

Reference Books:

1. The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers.

2. Convey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.

3. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

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

SEE- Semester End Examination

Theory (50 Marks)

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

DIGITAL ELECTRONIC CIRCUITS			
Course Code	**: ECE33**	**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	Recall the fundamental concepts of logic design
CO2	Demonstrate the simplification of Boolean expressions using standard methods
CO3	Utilize the knowledge of simplification by designing combinational logic circuits
CO4	Solve sequential logic circuits with the acquired knowledge of flip flops
CO5	Examine the significance of state machines in system design
CO6	Develop combinational and sequential circuits to meet the given 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	3	-	-	-	-	3	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	3	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	-	-
CO6	3	3	3	3	1	-	-	1	3	3	-	3	-	-

Module No	Module Contents	Hrs.	COs
1	Principles of Combinational Logic: Binary Logic functions, Definition of combinational logic, Canonical forms, Generation of switching equations from truthtable, Karnaugh maps (3,4and5variables), Quine – McClusky Method, Map entered Variables.	9	CO1 CO2
	List of Experiments Simplification of Boolean expressions using K-map and realization of simplified expressions using basic and universal gates. Realization of Half/Full adder and Half/Full subtractor using logic gates.	4	
2	Analysis and design of combinational logic: General Approach to combinational logic, Decoders, Encoders, Digital Multiplexers, Adders and Subtractor- Cascading full adders, Look Ahead carry adder, Binary Comparators, Code Conversion	9	CO2 CO3
	List of Experiments (i)Realization of parallel adder/Subtractorsusing7483chip (ii) BCD to Excess-3 code conversion and vice versa. Realization of Binary to Gray code conversion and vice versa MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code Converter. Realization of One/Two bit comparator and study of 7485 magnitude comparator. Use of a) Decoder chip to drive LED display and b) Priority encoder.	10	

3	Sequential Circuits – 1: Sequential circuit models, Basic Bi-stable Element, Latches-SR Latch, Application of SR Latch - A Switch Debouncer, $\overline{SR}$ Latch, The gated SR Latch, The gated D Latch, Timing Considerations, Flip-Flops- Latches, J-K Clocked Flip-Flops, Clocked T Flip-flop, Clocked D Flip-flop, The Master-Slave Flip-Flops, Edge Triggered Flip-Flop, catching 1s and 0s, Characteristic Equations	9	CO4
	List of Experiments Truth table verification of Flip-Flops: (i) JK Master slave(ii) T type and (iii) D type.	2	
4	Sequential Circuits – 2: Shift Registers: PIPO, SIPO, PISO, SISO, Universal Shift register. Counter: Ripple Counters, synchronous binary counter, Counters based on Shift Registers, Design of synchronous counters-Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops, clocked D, T, or SR Flip-Flops, Ring counter, Johnson counter	9	CO5 CO6
	List of Experiments Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95. Realization of synchronous and asynchronous counters. (7476, 7490, 74192, 74193). 3. Realization of Johnson and Ring counter.	6	
5	Sequential Design: Moore and Mealy State models, state machine notations, Synchronous Sequential Circuit Analysis, Construction of state diagrams. Logic Families: RTL and DTL circuits, TTL (Open-Collector output)	9	CO4 CO6
	List of Experiments 1. Design and implementation of synchronous or clocked sequential circuits using Mealy and Moore model	2	

TEXT BOOKS:

1. Digital Logic: Applications and Design, JohnM.Yarbrough,CengageLearning,2015 reprint.
2. Digital Principles and Design,DonaldD.Givone,2003,TataMcGrawHillEdition2002.
3. Digital Logic and Computer Design: M. Morris Mano, Pearson Education

REFERENCE BOOKS:

1. Digital Fundamentals, Thomas Floyd, 11th edition, 2014, Pearson Education.
2. An Illustrative Approach to Logic Design, R.D.Sudhakar Samuel,2010,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	5	-	-
Apply	10	5	5	5
Analyze	5	-	-	-
Evaluate	-	-	-	5
Create	-	-	-	-

Practical (25 Marks)

Bloom'sTaxonomy	Tests	Assignments	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
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

Practical (25 Marks)

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

ANALOG ELECTRONICS CIRCUITS			
Course Code	**:ECE34**	**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 basic knowledge of BJT and FET devices for designing circuits
CO2	Analyze load line concepts for various BJT and FET biasing circuits
CO3	Determine the high frequency response for BJT and JFET amplifier circuits using AC Analysis
CO4	Compare the effect of feedback topologies in amplifier circuits
CO5	Illustrate the working principles of oscillators and power amplifiers
CO6	Model the applications of diode, BJT and FET circuits using discrete components and simulation tools

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	2	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	-	3	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	3	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	3	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	3	-	-	-	-	-	-	-	3	-
CO6	3	3	2	2	3	-	-	-	2	2	-	2	3	2

Module No	Module Contents	Hrs.	COs
1	BJT BIASING AND AC ANALYSIS: Transistor configurations (CE, CB,CC), Need for Biasing, Load Line and Q-point, Biasing Circuits- Fixed Bias, Emitter Bias ,Voltage Divider bias with their stability factors. Analysis of various bias configurations using re transistor model, Complete hybrid equivalent model. Numerical Examples.	9	CO1 CO2 CO6
	List of Experiments 1. Testing of Diode clipping (Single/Double ended) circuits. (Hardwired) 2. Testing of Clamping circuits: positive clamping /negative clamping. (Hardwired) 3.Testing of voltage multipliers: doublers, triplers, quadruplers.(Simulation using Multisim / Pspice)	6	
2	JFET BIASING AND AMPLIFIERS: Construction and characteristics of JFET, JFET configurations (CS,CG,CD), JFET Biasing (Fixed bias, Self bias and Voltage divider bias), JFET small signal model of various biasing. Numerical Examples.	9	CO1 CO2 CO6
	List of Experiments 1. Plotting the transfer curve of transistor switch (BJT, JFET,MOSFET). (Hardwired). 2. Wiring of RC coupled Single stage BJT amplifier and Determination of the gain-frequency response, input and output impedances. (Hardwired).	4	

3	BJT AND JFET FREQUENCY RESPONSE: Introduction (Logarithms and Decibels), Bode plots, Miller's theorem, Rise time-Bandwidth relationship, low and high frequency response of BJT stages and FET amplifiers.	9	CO3 CO6
	List of Experiments Wiring of RC coupled Single stage JFET amplifier and Determination of the gain-frequency response, input and output impedances. (Hardwired) Simulation of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances. (Simulation using Multisim / Pspice).	4	
4	FEEDBACK AND OSCILLATOR CIRCUITS: The feedback concept, Feedback connection types, Practical Feedback Circuits, Theory of Sinusoidal Oscillation, Phase Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuits (Twin T, Colpitts, Hartley, Armstrong, Clapp), Crystal Oscillator, Uni-junction oscillator.	9	CO4 CO5 CO6
	List of Experiments Simulation of a two stage BJT Voltage series feedback amplifier and determination of the gain, Frequency response, input and output impedances with and without feedback. Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for 10 KHz.(Hardwired) Testing for the performance of BJT–Hartley & Colpitts Oscillators for RF range. (Hardwired)	6	
5	POWER AMPLIFIERS: Introduction (Amplifier Types and Efficiency), Class A amplifier (Series fed, Transformer coupled), Class B amplifier (Transfer coupled push-pull, Complementary Symmetry), Amplifier Distortion, Power Transistor Heat Sinking, Class C and Class D amplifiers.	9	CO5 CO6
	List of Experiments Simulation of a transformer less Class–B push-pull power amplifier and determination of its conversion efficiency. Testing of Class-C tuned amplifier, measurement of conduction angle and calculation of efficiency. (Hardwired)	4	

TEXT BOOKS:

1. Electronic Principles, Albert Malvino and David Bates,7th edition,2015,McGraw-Hill.
2. Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, 11th Edition, 2008, Pearson Education /PHI.

REFERENCE BOOKS:

1. ElectronicDevicesandCircuits,MillmanJandHalkiasC3rd edition, 2007,TMH.
2. Equipment manuals as applicable.

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
Analyze	10	-	5	-
Evaluate	-	5	-	5
Create	-	-	-	-

Practical (25 Marks)

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

SEE- Semester End Examination

Theory (50 Marks)

Bloom'sTaxonomy	Tests
Remember	20
Understand	10
Apply	10
Analyze	10
Evaluate	-
Create	-

Practical (25 Marks)

Bloom'sTaxonomy	Tests
Remember	10
Understand	5
Apply	10
Analyze	-
Evaluate	-
Create	-

NETWORK ANALYSIS			
Course Code	**:ECE35**	**Credits**	**:04**
L: P: T: S	**:3:0:1:0**	**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 electrical networks using nodal and mesh analysis techniques
CO2	Make use of the concepts of network theorems to solve the given electric circuits
CO3	Analyze the electric circuits using the Laplace transformation to solve for complex electrical circuits
CO4	Examine the electric circuits using network topology and formulate network equations
CO5	Model the parameters of two port networks
CO6	Evaluate the steady state and transient response of the electric 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	-
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	-	-	3	-	-	-	-	-	-	3	3	3
CO6	3	3	-	-	3	-	-	-	-	-	-	3	3	3

Module No	Module Contents	Hrs.	Cos
1	**Circuit Analysis (AC and DC circuits):** Nodal and Mesh Analysis, Super Node, Super Mesh, Delta-Wye Conversion. **Circuit Analysis Techniques:** Superposition, Reciprocity, Thevenin's, Norton's and Maximum power transfer theorems, Source Transformation, Concept of dependent sources.	9	CO1 CO2
2	**Network Topology and Equations**: Basic Definitions, Matrices of Graphs, Node and Mesh Transformations, Generalized Element, Formulation of Network Equations.	9	CO4
3	**Initial conditions**: Behavior of circuit elements under switching condition and their Representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. **Waveforms synthesis and transient response:** Shifted Unit Step Function, Ramp and Impulse Functions, Waveform Synthesis, Initial and final value of f(t) from F(s). Solution of networks.	9	CO3 CO6
4	**Two-port networks:** two-port parameters of networks: Z, Y, h and transmission parameters, relationships between 2-port parameters.	9	CO5

5	**Synthesis of One – Port Networks:** Network functions, Driving point impedance, Synthesis of L-C, R-C, R-L networks. **Resonant Circuits:** Series and parallel resonance (with varying frequency), frequency response of series and Parallel circuits, Q –factor, Bandwidth.	9	CO6

Text Books:

1. Network Analysis, M. E. Van Valkenburg, 3rd Edition, 2014, PHI / Pearson Education

Reference Books:

1. Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 8th Edition, 2013, TMH Education
2. Networks and systems, Roy Choudhury, 2nd edition, 2013, New Age International 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	5	-	-
Understand	10	-	-	-
Apply	5	5	5	5
Analyze	5	-	-	-
Create	-	-	-	5

SEE- Semester End Examination

Theory (50 Marks)

Bloom's Taxonomy	Tests
Remember	10
Understand	10
Apply	30
Analyze	-
Evaluate	-
Create	-

SIGNALS AND SYSTEMS			
Course Code	**:ECE36**	**Credits**	**:03**
L: P: T: S	**:3:0:0:0**	**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	Classify the continuous time and discrete time signals and systems
CO2	Apply the knowledge of systems to obtain the properties of LTI systems
CO3	Use the convolution operator to compute the response of LTI system
CO4	Design the spectral characteristics of signals using Fourier analysis
CO5	Examine the properties of Fourier analysis for solving complex problems
CO6	Analyze the discrete time systems in Z domain

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	-
CO3	3	3	3	-	1	-	-	-	-	-	-	-	3	-
CO4	-	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	-	3	3	1	-	-	-	-	-	-	-	-	3	3
CO6	3	3	-	-	-	-	-	-	-	-	-	-	3	3

Module No	Module Contents	Hrs.	COs
1	Classification of Signals: Continuous time signals, Discrete time signals, Periodic and Aperiodic signals, Even and odd signals, Energy and power signals, Deterministic and random signals, Complex exponential and Sinusoidal signals. Unit step, Unit ramp, Unit impulse, Representation of signals in terms of unit impulse. Classification of Systems: Continuous time systems, Discrete time systems, Linear system, Time Invariant system, causal system, BIBO system, Systems with and without memory, LTI systems.	9	CO1 CO2
2	Time-domain representations for LTI systems: Convolution, Properties of convolution, Convolution Sum and Convolution Integral for infinite duration sequences, Properties of impulse response representation, Solutions of differential and difference equations.	9	CO1 CO2 CO3
3	Fourier series representation of periodic signals: Representation of Fourier series, Properties of Fourier series, Dirichlet conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.	9	CO4 CO5
4	Fourier transform representation of a signal: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals,PropertiesofFouriertransforms,Fouriertransformsinvolving impulse function and Signum function, Introduction to Hilbert Transform	9	CO4 CO5

5	**Z-transform**: Computation of impulse response, step response, output response of a discrete-time LTI system using Z-transform, determining transfer function using Z-Transform, determining stability, causality, inverse system, poles and zeros of a discrete-time LTI system.	6	CO6

TEXT BOOKS:

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, 2007, John Wiley & sons.

REFERENCE BOOKS:

1. SignalsandSystems,AllenV.Oppenheim,AllenS.Willsiky,S.HamidNawab,2015,PHI.
2. PrinciplesofLinearSystemsandSignals,B.P.Lathi,2nd edition,2009,OxfordUniversity Press.
3. SignalsandSystems,UdaykumarS,6th edition,2012,PrismbookHouse.

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

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

Note: i)For a given LTI system, for any given input, the student should be able to judge upon the output. ii) A given signal has to be represented in frequency domain using Fourier Transform. These two assignments have to be given during the semester, and have to be evaluated for 5 marks each, under "Evaluate" category.

SEE- Semester End Examination (50 Marks)

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

MINI PROJECT-I			
Course Code	**:ECE37**	**Credits**	**:02**
L: P: T: S	**:0:2:0:0**	**CIE Marks**	**:25**
Exam Hours	**:03**	**SEE Marks**	**:25**

The student will have the ability to

	Course outcomes
CO1	Understand the methodologies of technical projects
CO2	Develop the product for the required specifications
CO3	Work as an individual or in a team in development of technical projects
CO4	Test the product for the required specification
CO5	Articulate the project related activities and findings
CO6	Enhance the idea of project for extended applications

Mapping of Course Outcomes to Program Outcomes:

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

New Horizon College of Engineering, Bangalore

B.E. Program - Batch: 2017-2021

Department of Electronics and Communication Engineering

Academic Year: 2018 – 2019

Syllabus of Fourth Semester

Sl. No.	Course code	Course title	Credit Distribution				Overall Credits	Theory Hours	Lab Hours	Marks		
			L	P	T	S				CIE	SEE	Total
1	MAT41	Engineering Mathematics-IV	4	0	1	0	5	6	0	50	50	100
2	HSS421	Economics for Engineers	2	0	0	1	3	2	0	50	50	100
3	ECE43	System Design using HDL	3	2	0	0	5	3	4	75	75	150
4	ECE44	Digital Signal Processing	3	2	0	0	5	3	4	75	75	150
5	ECE45	Control Systems	3	0	1	0	4	5	0	50	50	100
6	ECE46	Linear Integrated Circuits	3	0	0	0	3	4	0	50	50	100
7	ECE47	Mini Project-II	0	2	0	0	2	0	0	25	25	50
		TOTAL					**27**	**23**	**8**	**375**	**375**	**750**

ENGINEERING MATHEMATICS – IV			
Course Code	**:MAT41**	**Credits**	**:05**
L: P: T: S	**:4:0:1:0**	**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 initial value problems using appropriate numerical methods
CO2	Understand the concepts of Complex variables and transformation for solving Engineering Problems
CO3	Understand the concepts of complex integration and its applications in the stability analysis of engineering problems
CO4	Gain ability to use probability distributions to analyze and solve real time problems
CO5	Apply the stochastic process and Markov chain in prediction of future events
CO6	Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous probability and statistical methods

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	-	2	-	-	-	3	3	-	-
CO2	-	3	-	-	3	-	-	-	-	-	3	3	-	-
CO3	-	3	-	-	3	-	-	-	-	-	3	3	-	-
CO4	3	3	3	3	3	3	-	-	2	1	3	3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	-
CO6	3	3	3	3	3	3	2	-	2	-	3	3	-	-

Module No	Module Contents	Hrs.	COs
1	**Numerical Methods:** Numerical solution of ordinary differential equations of first order and of first degree: single step methods- Picard's Method, Taylor's series method, modified Euler's method and Runge-Kutta method of fourth-order. Multi step methods- Milne's and Adams-Bashforth predictor and corrector methods. Numerical solution of simultaneous first order differential equations ; Picard's Method and Runge-Kutta Method of fourth-order(no derivation of formulae).	9	CO1
2	**Complex Variables:** Functions of Complex Variables, Analytical functions, Cauchy's Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions. Discussion of Transformations: $w = z^2$, $w = e^z$ and $w = z + (1/z)$ and Bilinear Transformations	9	CO2
3	**Complex Integrations:** Complex line integrals–Cauchy's theorem and Cauchy's Integral formula. Power Series, Laurent's series. Singularities, Poles and Residuals, Residual Theorem-Problems(without proof).	9	CO3
4	**Probability distributions:** Random variables (discrete and continuous), probability density function, cumulative density function.	9	CO4

	Discrete Probability distributions: Binomial and Poisson distributions. Continuous Probability distributions: Exponential and Normal distributions. **Joint Probability distributions:**Mathematical expectation, correlation, covariance (discrete random variables only).		
5	**Sampling Theory:** Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's,t-distributionand Chi-square distribution for test of goodness of fit. **Stochastic Processes:** Stochastic processes, Probability Vectors, Stochastic matrix, Regular stochastic matrix, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states.	9	CO5 CO6

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition,2014, Wiley-India publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43rdedition, 2014, Khanna Publishers.

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4th edition, 2015, Pearson Education.
2. Advanced Engineering Mathematics, Dennis G. Zill, Michael R. Cullen, 4th edition, 2015, Jones and Barlett Publishers Inc.
3. Engineering Mathematics, B. V. Ramana, 4th edition, 2005, Tata McGraw Hill Publications.
4. Engineering Mathematics, Anthony Craft, 4th edition, 2013, Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	**30**	**10**	**10**
Remember	10	3	5
Understand	5	5	5
Apply	5	2	-
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination

Theory (50 Marks)

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

ECONOMICS FOR ENGINEERS			
Course Code	**:HSS421**	**Credits**	**:03**
L: P: T: S	**:2:0:0:1**	**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	Gain knowledge about importance of economics in decision making processing in day to day life
CO2	Analyze business environment at micro and macro economics level and its impact on industries in country economy
CO3	Acquire knowledge about costing and estimate of project for profit making
CO4	Apply principles of budgeting and finance for entrepreneurial success

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	1	-	1	-	1	2	2	-	2	2	2	1
CO2	2	2	1	-	1	-	1	2	2	-	2	2	2	1
CO3	2	2	1	-	1	-	1	2	2	-	2	2	2	1
CO4	2	2	1	-	1	-	1	2	2	-	2	2	2	1

Module	Contents of Module	Hours	COs
I	**Introduction to Economics**: Role of Engineer as an Economist, Types and problem of economies, Basics of economics (GDP, National income, inflation, business cycle, fiscal and monetary policies, balance of payment).	**4**	CO1 CO3
II	**Basic concepts of Microeconomics**: concept of Demand & Elasticity of Demand. Concept of Supply & Elasticity of Supply, Meaning of Production and factors of production, Production Possibility Curve, Law of variable proportions and returns to scale. Relevance of Depreciation towards industry, Depreciation computing methods.	**5**	CO2 CO3
III	**Concepts of cost of production**: different types of cost; accounting cost, sunk cost, marginal cost and opportunity cost. Break even analysis, Make or Buy decision. Cost estimation, Elements of cost as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads.	**4**	CO3 CO4
IV	**Capital budgeting**: Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI. . Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loansand EMI Payment. Present worth, Future worth.	**4**	CO1 CO3 CO4
V	**Book Keeping and Accounts**: Journal, Ledger, Trial balance, asset Types, profit & loss account, balance sheet.	**5**	CO1 CO2 CO3 CO4

TEXT BOOKS:

1. Riggs J.L, Engineering Economy,TMH,2012edition
2. Jain T.R., Economics for Engineers, VK Publications
3. IM PANDEY,Finacial Management, Vikas Pub.House
4. D N Dwivedi, Mangerial Economics , Vikas Pub.House

REFERENCE BOOKS:

1. Thuesen H.G, Engineering Economy.PHI
2. Prasanna Chandra, Financial Mangement, TMH
3. Singh Seema, Economics for Engineers, IK International
4. Chopra P.N, Principle of Economics, Kalyani Publishers
5. Dewett KK, Modern Economic Theory, S. Chand
6. H. L. Ahuja, Modern Economic Theory, S. Chand
7. Mishra S. K, Modern Micro Economics, Pragathi Publications
8. Gupta Shasi K, Management Accounting, Kalyani Publications

Assessment pattern

CIE –Continuous Internal Evaluation(50 Marks, Theory)

Bloom's category	**Test**	**Assignments**	**SSR**
Marks (out of 50)	**20**	**15**	**15**
Remember	5	-	-
Understand	5	-	-
Apply	5	-	-
Analyze	5	5	5
Evaluate	-	5	5
Create		5	5

SEE –Semester Ending Examination (50 Marks)

Bloom's category	**Test**
Remember	20
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

SYSTEM DESIGN USING HDL			
Course Code	**:ECE43**	**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	Identify the necessity of HDL for the automation of VLSI design
CO2	Employ Verilog for the combinational, sequential and mixed designs
CO3	Recognize the necessity of synthesis of HDL in the form of RTL
CO4	Write the design that is in the form of state machine into Verilog code
CO5	Examine the usage of the programmable devices and their architectures
CO6	Demonstrate the HDL code for digital applications by means of verification and implementation

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	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	2	3	-
CO6	3	3	3	2	-	-	-	-	-	-	-	-	3	-

Module No	**Module Contents**	**Hrs**	**Cos**
1	INTRODUCTION TO VERILOG: Computer-Aided Design, Hardware Description Languages, Verilog Data Types and Operators, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioraland Structural Verilog.	09	CO1 CO2
	List of Experiments Write an HDL code to realize all logic gates. Write an HDL code to describe the functions of a Full Adder using three modeling styles. Write a model for 16bit ALU using the 4bit opcodes; the requisite functions can be defined for the chosen opcodes.	06	
	SIMULATION AND SYNTHESIS: Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Simple Synthesis Examples. Constants, Arrays, Loops in Verilog, Testing Verilog Model, Verilog functions, Verilog Tasks	09	

2	List of Experiments Write an HDL program for the following designs: Decoder Encoder (without priority and with priority) Multiplexer and Demultiplexer 4 bit Binary to Gray converter 4-bit BinaryComparator.	06	CO3
3	INTRODUCTION TO PROGRAMMABLE LOGICDEVICES: Brief Overview of Programmable Logic Devices. Simple Programmable Logic Devices (SPLDs)- Read Only Memories, Programmable Logic Arrays, Programmable array Logic. Complex Programmable Logic Devices (CPLDs). Field Programmable Gate Arrays (FPGAs) - Organization of FPGAs, FPGA Programming techniques, Programmable Logic block Architecture, Design flow of FPGAs. State Machine charts, Derivation of SM charts- Binary Multiplier, Realization of SM charts	09	CO4 CO5
	List of Experiments 1. Develop the HDL code for the following flipflops: T, D,SR, JK.	04	
4	DESIGNEXAMPLES:BCD to 7-SegmentDisplayDecoder, A BCD Adder, 32-Bit Adders. Traffic Light Controller. State Graphs for Control Circuits. Score board and Controller. Synchronization and Debouncing. A Shift-and-Add Multiplier, Array Multiplier, Keypad Scanner.	09	CO2
	List of Experiments 1. Design 4bit Binary and BCD counters(Synchronous reset and synchronous reset and "any sequence" counters). . Write an HDL code to display messages on the given seven segment display	04	
5	DESIGNING WITH FIELD PROGRAMMABLE GATE ARRAYS: Implementing Functions in FPGAs, Implementing Functions Using Shannon's Decomposition, Carry Chains in FPGAs, Cascade Chains in FPGAs, Dedicated Memory in FPGAs, Dedicated Multipliers in FPGAs, FPGAs and One-Hot State Assignment, FPGA Capacity: Maximum Gates versus Usable Gates, Design Translation (Synthesis),Mapping, Placement, and Routing.	9	CO5 CO6
	List of Experiments 1. Write an HDL code to control Speed, direction of DCand Stepper Motor 2. Write an HDL code to generate different waveforms(Saw tooth, sine wave, square, triangle, ramp etc.,) using DAC and FPGA kit.	04	

Text Books:

1. DigitalSystemdesignUsingVerilog,CharlesH.RothJr.,LizyKurianJohn,ByeongKilLee, 1st Edition, 2015, CL Engineering.
2. Digital Systems Design using VHDL, Charles H Roth,Jr., 2007, Thomson.

Reference books:

1. HDLProgramming(VHDLandVerilog),NazeihM.Botros,2015,John-WeilyIndiaPvt.Ltd.
2. DigitalDesign:AnEmbeddedSystemsapproachUsingVERILOG,PeterJ.Ashenden,2014, Elsevier.

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	5
Analyze	5	-	-	-
Evaluate	-	-	-	5
Create	-	-	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Assignments	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	20
Apply	20
Analyze	-
Evaluate	-
Create	-

Practical (25 Marks)

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

DIGITAL SIGNAL PROCESSING			
Course Code	**:ECE44**	**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 knowledge of signals to understand DSP fundamentals
CO2	Use Fourier analysis to compute DFT and its properties
CO3	Demonstrate the efficient algorithms of FFT in DFT calculations
CO4	Realize digital filters to compute the response of the system.
CO5	Design digital filters with desired frequency response.
CO6	Use modern tools for application of DSP in real time world

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	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	1	1	-	1	3	3

Module No	Module Contents	Hrs	COs
1	**Introduction to Signal Processing and Discrete Fourier Transforms (DFT):** Basic elements of a digital signal processing system, Advantages and limitations of digital signal processing, Applications of DSP. Frequency domain representation of discrete time signals and systems. Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with othertransforms.	09	CO1
	LIST OF EXPERIMENTS USING MATLAB 1. Computation of N point DFT of a given sequence and to plot Magnitude and phase spectrum. 2. Computation of the impulse response of a discrete-time LTIsystem. **LIST OF EXPERIMENTS USING DSP PROCESSOR** 1. Computation of N- Point DFT of a given sequence 2. Impulse response of first order and second order system **LIST OF EXPERIMENTS USING SIMULINK** 1. Sampling of a signal 2. Computation of N- Point DFT of a given sequence	06	

2	**Properties of Discrete Fourier Transforms(DFT):**Properties of DFT, multiplication of two DFTs- the circular convolution, additional DFT properties, use of DFT in linear filtering overlap-save and overlap-add method.	09	CO2 CO3
	LIST OF EXPERIMENTS USING MATLAB 1. Linear convolution of two sequences using time-domain and DFT and IDFT 2. Circularconvolutionof2givensequencesusingtime-domain and DFT &IDFT 3. Auto correlation of two sequences using time-domain and DFT and IDFT 4. Cross correlation of two sequences using time-domain and DFT and IDFT 5. Circular convolution of two given sequences using time- domain and DFT and IDFT **LIST OF EXPERIMENTS USING DSP PROCESSOR** 1. Linear convolution of two given sequences. 2. Circular convolution of two given sequences.	06	
3	**FFT algorithms:** Direct computation of DFT, need for efficient computation of the DFT, Radix-2 FFT algorithm for the computation of DFT and IDFT, decimation-in-time and decimation-in-frequency algorithms, Goertzel Algorithm.	09	CO3
	LIST OF EXPERIMENTS USING MATLAB 1. Matlab Code for implementing Goertzel Algorithm.	02	
4	**Design and Implementation of IIR Filters:** Introduction**,** IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters, analog to analog frequency transformations, Design of IIR filters from analog filters, Mapping of transfer functions: impulse invariance method and bilinear transformation, Structures for IIR filters (DF1, DF2, cascade and parallel)	09	CO4 CO5 CO6
	LIST OF EXPERIMENTS USING MATLAB 1. Design and implementation of IIR filters of different types (butterworth and chebyshev: low pass, high pass,band pass and band reject) to meet given specifications **LISTOFEXPERIMENTSUSINGSIMULINK** 1. Design of IIR filter of different types (Butterworth and Chebyshev: low pass, high pass, band pass and band reject) to meet given specifications	04	
5	**Design and Implementation of FIR Filters:** Introduction, FIR filter design: Introduction to FIR filters, design of FIR filters using - Rectangular, Hamming, Bartlett and Kaiser windows, Structures for FIR filters systems (Only DF1 and DF2)	09	CO4 CO5 CO6

	LIST OF EXPERIMENTS USING MATLAB 1. Design and implementation of FIR filters to meet given specifications **LIST OF EXPERIMENTS USING DSP PROCESSOR** 1. Realization of an FIR filter (any type) to meet given specification. The input can be a signal from function generator / speech signal. 2. Application of FIR filter for audio such as to plot time and frequency (Spectrum) display of Microphone output using DSP **LIST OF EXPERIMENTS USING SIMULINK** Design of FIR filter to meet given specifications	06	

TEXT BOOKS:

1. Digital signal processing: Principles, Algorithm & Applications, Proakis & Monalakis, 4th Edition, 2014, Pearson education.
2. Digital Signal Processing, S.K.Mitra, 4thEdition, 2014,TataMc-Graw Hill.

REFERENCE BOOKS:

1. DiscreteTimeSignalProcessing,Oppenheim&Schaffer,7thEdition,2010,TMH.
2. DigitalSignalProcessing,D.GaneshRao,2ndedition,2010,PearsonEducationIndia.

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	10	5	5	5
Analyze	-	-	-	-
Evaluate	-	-	-	5
Create	-	5	-	-

Practical (25 Marks)

Bloom's Taxonomy	Tests	Quizzes
Marks	**20**	**5**
Remember	5	-
Understand	5	5
Apply	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	-

Practical (25 Marks)

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

CONTROL SYSTEMS			
Course Code	**:ECE45**	**Credits**	**:04**
L: P: T: S	**:3:0:1:0**	**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	Illustrate the basic concepts of control systems with various examples
CO2	Apply the transfer function concepts to develop the Mathematical Models for electrical and mechanical systems
CO3	Examine the system response in Time domain for first order and second order systems
CO4	Differentiate the stability of the system in S-Domain and frequency domain
CO5	Infer the stability of the open and closed loop system from the frequency domain specifications
CO6	Solve state equations based on the concepts of state model

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	-
CO4	-	3	3	2	-	-	-	-	-	-	-	3	3	-
CO5	-	3	3	2	-	-	-	-	-	-	-	-	3	-
CO6	3	-	-	-	-	-	-	-	-	-	-	3	3	-

Module No	Module Contents	Hrs.	Cos
1	**Introduction:** Basic Elements of Control System - Open loop and Closed loop systems, Feed-Back Characteristics, Effects of feedback, Differential equation - Transfer function, Modeling of Electric systems - Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph using masons gain formula. **Case study:** Different examples on open loop and closed loop systems, Revision of Laplace Transform Concepts.	9	CO1 CO2
2	**Time Response Analysis:** Standard test signals, Time response of first order and second order systems, Steady state analysis: steady state error and error constants, transient response of second order systems. Effects of proportional derivative, proportional integral and proportional derivative and integral systems. **Case Study:** Analysis of second order time response using Matlab.	9	CO3
3	**Stability Analysis in S-Domain**: The concept of stability, Routh – Hurwitz's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. **Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the rootloci. **Case Study:** Analysis of Root Locus using Matlab.	9	CO4 CO5

4	**Frequency Response Analysis:** Introduction, Correlation between time and frequency domain, Frequency domain specifications, Bode diagrams, Determination of Frequency domain specifications, Phase margin and Gain margin, Stability analysis from Bode Plots, Determination of transfer function from Bode plots, Polar plots, Stability analysis using Nyquist plots, Compensation techniques–Lag,Lead, Lead-Lag Controllers in frequency domain.	9	CO4 CO5
5	**State Space Analysis of Continuous Systems:** Concept of state, state variables and state model, State models for continuous time systems (SISO, MIMO) – derivation of transfer function from state models and vice versa, Diagonalization- Solution of state Equations, state transition matrix and its properties, Controllability and Observability	9	CO1 CO6

Text Books:

1. Control Systems Engineering, Nagrath I. J. and M. Gopal, 5th Edition, 2016, New Age Publications.
2. Control System Engineering, Norman S. Nise, 5th Edition, 2007,Wiley.

Reference Books:

1. Modern Control Engineering, Ogata Katsuhiko, 5th Edition, 2010,PHI.
2. Control Systems, 3rd Edition, 2013, Schaum's Outlines.

Assessment Pattern

CIE- Continuous Internal valuation
Theory(50 Marks)

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

SEE- Semester End Examination
Theory(50 Marks)

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

LINEAR INTEGRATED CIRCUITS			
Course Code	**:ECE46**	**Credits**	**:03**
L: P: T: S	**:3:0:0:0**	**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	Classify the basic building blocks and compare the various parameters of linear integrated circuits
CO2	Interpret the DC and AC characteristics of operational amplifiers, their effect on output, and the compensation techniques.
CO3	Apply the theory of op amps in applications of op amps related to analog signal processing domain/industry
CO4	Design various signal processing circuits and voltage regulators using linear and non linearICs.
CO5	Design of analog filters using operational amplifiers by utilizing an in depth understanding of its frequency response
CO6	Demonstrate the theory of ADC, DAC, TIMER and special purpose ICs.

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	-	-	-	-	-	-	1	3	3	3
CO4	3	3	3	3	3	1	-	-	3	-	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	3	3	-	3	-	3

Module No	Module Contents	Hrs.	COs
1	**OPERATIONAL AMPLIFIER FUNDUMENTALS:** Basic Op-Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate, Frequency limitations and effect of finite open loop gain. (Qualitative analysis). Op-Amps as DC Amplifiers-Direct coupled – Voltage Followers, Non- inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier. Op-Amps as AC Amplifiers - Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, and Capacitor coupled Inverting amplifiers	9	CO1 CO2
2	**OP-AMP FREQUENCY RESPONSE AND COMPENSATION:** High input impedance - Capacitor coupled Voltage Follower, setting the uppercut- off frequency, Use of a single polarity power supply, Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Zin Mod compensation, and circuit stability precautions	9	CO2

3	**OP-AMP APPLICATIONS:** Voltage sources, current sources, Integrator and differentiator, Inverting and non-inverting summer, Log and antilog amplifiers, Instrumentation amplifier, Precision rectifiers, Limiting Circuits,Sampleandholdcircuits,Zerocrossingdetectors,InvertingSchmitt trigger circuits.	9	CO3 CO4
4	**FILTERS AND IC REGULATORS:** RC low-pass and high-pass circuit**,** Active Filters – First and second order Low pass & High pass filters, Band pass and Band Elimination filters, IC Voltage regulators, 723 general purpose regulator, Switching regulator.	9	CO4 CO5
5	**OTHER LINEAR IC APPLICATIONS:** 555 Timer and its different circ applications, High speed micro power timer (ALD1502), Precision wavefo generator(ICL8038), PLL-operating principles, Phase detector/comparat LM566VCO,D/A(R-2R) and A/D converters (SAR and counter type), Analog multipli	6	CO6

TEXT BOOKS:

1. Operational Amplifiers and Linear IC's, David A. Bell, 3rd edition,2011, Oxford University Press.
2. LinearIntegratedCircuits,D.RoyChoudharyandShailB.Jain,4th edition,2015, New Age International.
3. Pulse, Digital and Switching Waveforms, JacobMillmanandHerbertTaub,2000,TMH Edition.

REFERENCE BOOKS:

1. Opamps-Design,Applications and Troubleshooting, Terrell,3rd edition,2006, Elsevier.
2. OperationalAmplifiers,GeorgeClaytonandSteveWinder,5th edition,2008, Elsevier.
3. OperationalAmplifiersandLinearIntegratedCircuits,Robert.F.Coughlin&FredF. Driscoll, 2006,PHI/Pearson.
4. DesignwithOperationalAmplifiersandAnalogIntegratedCircuits,SergioFranco, 3rd edition, 2005,TMH.

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**	**CO-Curricular Activities**
Marks (out of 50)	25	10	5	10
Remember	5	-	-	-
Understand	10	5	-	-
Apply	5	5	-	5
Analyze	5	-	5	-
Evaluate	-	-	-	5
Create	-	-	-	-

SEE- Semester End Examination (50 Marks)

Bloom's Category	**Tests**
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	-
Create	-

MINI PROJECT-II			
Course Code	**:ECE47**	**Credits**	**:02**
L: P: T: S	**:0:2:0:0**	**CIE Marks**	**:25**
Exam Hours	**:03**	**SEE Marks**	**:25**

The student will have the ability to

	Course outcomes
CO1	Identify the problem statement,objectives and methodologies to carry out the project
CO2	Analyze suitable hardware and software required to do the project
CO3	Design engineering solutions of the chosen project utilizing a comprehensive and systematic approach
CO4	Demonstrate technical aspects of application specific prototypes
CO5	Work as an individual or in a team work in development of technical projects
CO6	Articulate the project related activities and findings

Mapping of Course Outcomes to Program Outcomes:

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

APPLIED MATHEMATICS-I			
Course Code	**: DMAT31**	**Credits**	**:0**
L: P: T: S	**: 1:0:0**	**CIE Marks**	**:25**
Exam Hours	**: 02**	**SEE Marks**	**:25**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Learn the principles of engineering mathematics through calculus
CO2	Determine the power series expansion of a function
CO3	Find the definite integrals with standard limits
CO4	Develop the ability to solve different types of differential equations
CO5	Apply ideas from linear algebra in solving systems of linear equations
CO6	Determine Eigen values and Eigen vectors of a matrix

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs.	Cos
1	**Differential Calculus:** Polar curves-Problems on angle between the radius vector and tangent, Angle between two curves-Problems, Pedal equation for polar curves-Problems. Macluren's theorems for function of one variable (statement only)-Problem**s.**	5	CO1 CO2
2	**Partial differentiation:** Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation and NO extended theorem)-Problems, Partial differentiation of composite functions (chain rule)-Problems, Jacobians of order two - definition and problems.	5	CO1
3	**Integral Calculus and Differential Equations:** Problems on reduction formulae for functions sin n x, cos n x, Problems on evaluation of these integrals with standard limits (0 to $\pi/2$). Solution of first order and first degree differential equations-Variable separable, Linear and Exact differential equations.	5	CO3 CO4

4	**Linear Algebra-1:** Problems on rank of a matrix by elementary transformations, consistency of a system of linear equations and solution (homogeneous and non-homogeneous)-Problems. Solution of system of linear equations by Gauss elimination method-Problems.	5	CO5
5	Linear Algebra-2: Linear transformation, Eigen values and Eigen vectors, diagonalisation of a square matrix-Problems.	5	CO6

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests (20 Marks)	Assignment (5 Marks)
Remember	5	-
Understand	5	5
Apply	5	-
Analyze	2.5	-
Evaluate	2.5	-
Create	-	-

SEE- Semester End Examination (25 Marks)

Bloom's Category	Questions (25 Marks)
Remember	5
Understand	10
Apply	5
Analyze	2.5
Evaluate	2.5
Create	-

APPLIED MATHEMATICS-II			
Course Code	**: DMAT41**	**Credits**	**:0**
L: P: T: S	**: 1:0:0**	**CIE Marks**	**:25**
Exam Hours	**: 02**	**SEE Marks**	**:25**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Gain knowledge of basic operations of vectors
CO2	Use curl and divergence of a vector function in three dimensions
CO3	Develop the ability to solve higher order Linear differential equations
CO4	Understand basic concepts of Laplace transform to engineering problems
CO5	Solve the Laplace transform of Periodic and Step functions
CO6	Solve initial and boundary value problems using Laplace transform method

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs.	Cos
1.	Vectors: Definition of scalar and vector, Vector addition, Subtraction and Multiplication-Dot product, Cross product, Scalar triple product. Orthogonal, Co-planar and Angle between vectors-Problems.	5	CO1
2.	Vector Differentiation: Velocity and Accelerations, Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of vector function-Problems. Solenoidal and irrotational vector fields-Problems.	5	CO2
3.	Linear differential equations with constant coefficients: Solution of initial and boundary value problems, Inverse differential operator techniques for the functions-e^{ax}, $\sin(ax+b)$ and $\cos(ax+b)$.	5	CO3
4.	Laplace Transform: Definition and Laplace transforms of elementary functions-Problems. Properties of Laplace transforms (without proof), Periodic functions(without proof), Heaviside function(without proof) -Problems.	5	CO4, CO5
5.	Inverse Laplace Transform: Inverse Laplace Transform by partial fractions, completing the square method-Problems. Solution of linear differential equations using Laplace Transforms-Problems.	5	CO6

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests (20 Marks)	Assignment (5 Marks)
Remember	5	-
Understand	5	5
Apply	5	-
Analyze	2.5	-
Evaluate	2.5	-
Create	-	-

SEE- Semester End Examination (25 Marks)

Bloom's Category	Questions (25 Marks)
Remember	5
Understand	10
Apply	5
Analyze	2.5
Evaluate	2.5
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.

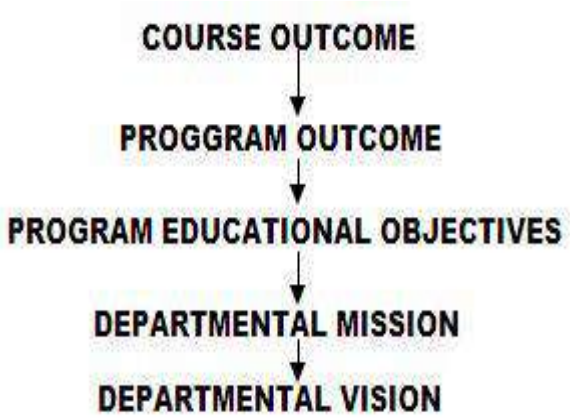
There are three educational Outcomes as defined by the National Board of Accreditation:

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 anddesign 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 bystraightforward 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 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.

Project management and finance: 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.

Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent 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.