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 2019-20

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

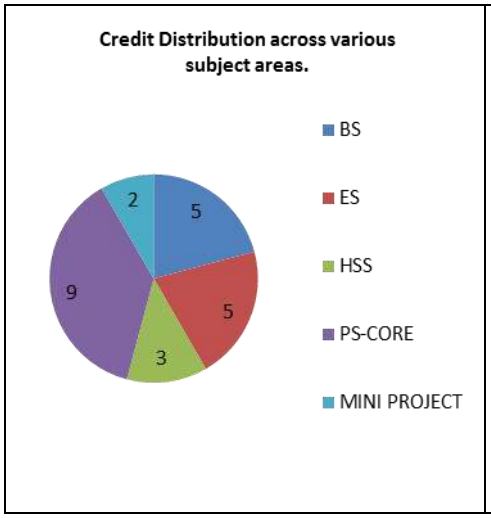
PSO1	To demonstrate the ability to design and develop complex systems in the areas of next generation Communication Systems, IoT based Embedded Systems, Advanced Signal and Image Processing, latest Semiconductor technologies, RF and Power Systems.
PSO2	To demonstrate the ability to solve complex Electronics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

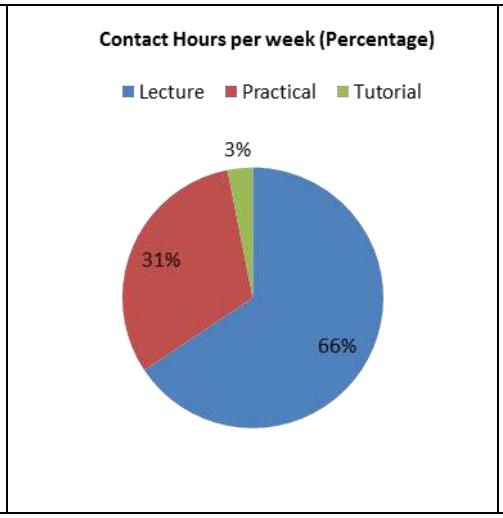
Mapping of PEOs to POs & PSOs

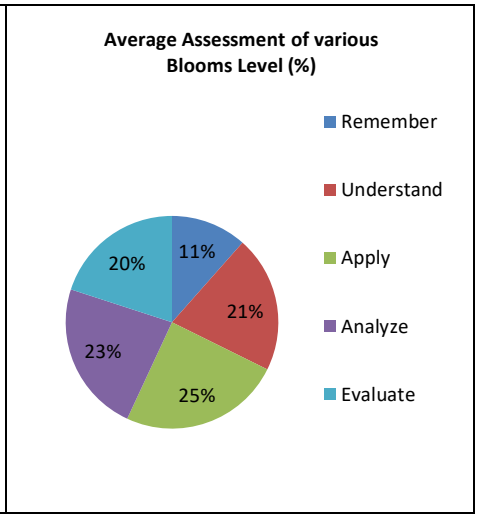
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PEO1	3	3	2	2	2	1	1	1	1	1	1	1	1	1
PEO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2
PEO3	3	3	3	3	3	3	3	2	2	2	2	2	3	3
PEO4	1	1	1	1	1	2	2	3	3	3	3	3	1	1

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

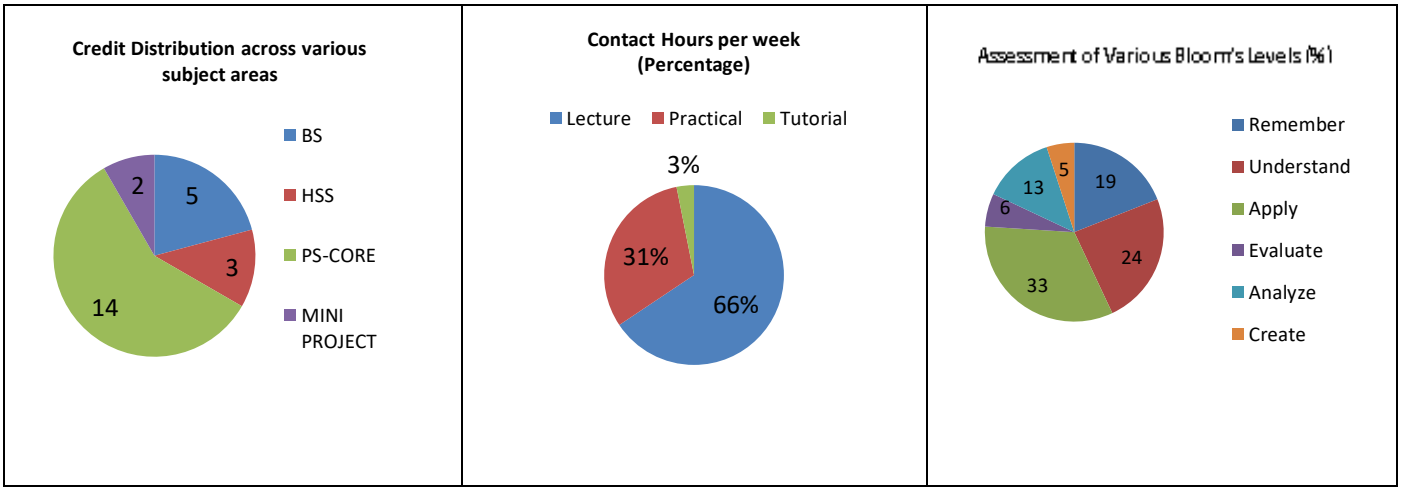
		New Horizon College of Engineering Department of Electronics and Communication Engineering Scheme of III Semester (Autonomous) (2019-20)									
		Semester III									
Sl. No.	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact hours	Marks		
				L	T	P			CIE	SEE	Total
1	19ECE31	Applied Mathematics-III	BS	2	1	0	3	4	50	50	100
2	19HSS322	Life Skills for Engineers	HSS	3	0	0	3	3	50	50	100
3	19ECE33	Digital Electronic Circuits	ECE	3	0	0	3	3	50	50	100
4	19ECE34	Analog Electronic Circuits	ECE	3	0	0	3	3	50	50	100
5	19ECE35	Network Analysis	ECE	3	0	0	3	3	50	50	100
6	19ECE36	Signals and Systems	ECE	2	1	0	3	4	50	50	100
7	19ECL37	Digital Electronic Circuits Lab	ECE	0	0	1.5	1.5	3	25	25	50
8	19ECL38	Analog Electronic Circuits Lab	ECE	0	0	1.5	1.5	3	25	25	50
9	19ECL39	Mini project-I	ECE	0	0	2	2	0	25	25	50
						Total	**23**	**26**	**375**	**375**	**750**







	New Horizon College of Engineering Department of Electronics and Communication Engineering Scheme of IV Semester (Autonomous) (2019-20)									
	Semester IV									
Sl. No.	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact hours	Marks		
				L	T	P			CIE	SEE	Total
1	19ECE41	Applied Mathematics-IV	BS	2	1	0	3	4	50	50	100
2	19HSS421	Economics for Engineers	HSS	2	0	0	3	3	50	50	100
3	19HSS423	Environmental Science and Awareness	HSS	0	0	0	0	1	25	25	50
4	19ECE43	System Design using HDL	ECE	3	0	0	3	3	50	50	100
5	19ECE44	Digital Signal Processing	ECE	3	0	0	3	3	50	50	100
6	19ECE45	Control Systems	ECE	2	1	0	3	4	50	50	100
7	19ECE46	Linear Integrated Circuits	ECE	3	0	0	3	3	50	50	100
8	19ECL47	Hardware Description Language Lab	ECE	0	0	1.5	1.5	3	25	25	50
9	19ECL48	Digital Signal Processing Lab	ECE	0	0	1.5	1.5	3	25	25	50
10	19ECL49	Mini project-II	ECE	0	0	2	2	0	25	25	50
						Total	**23**	**27**	**400**	**400**	**800**



THIRD SEMESTER

(SYLLABUS)

APPLIED MATHEMATICS – III	
Course Code: 19ECE31	**Credits: 3**
L: T: P : 2:1:0	**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	Use appropriate numerical methods to solve algebraic equations and transcendental equations and also Evaluate a definite integral numerically
CO2	Evaluate a definite integral numerically and Use appropriate numerical methods to solve Boundary Value Problems in Partial differential equations
CO3	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data and obtain the extremal of a functional.
CO4	Express the periodic functions as Fourier series expansion analytically and numerically
CO5	Solve the Continuous model problems using Fourier transforms
CO6	Solve the discrete model problems using Z-transforms

Mapping of Course Outcomes to Program Outcomes:

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

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**Co's**
1.	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals (without proofs)-Problems.	**9L + 2T**	**CO1**
2.	**Numerical Methods-2**: Numerical integration: Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule (without proofs)-Problems. Numerical solution of one-dimensional wave equation, heat equation and two-dimensional Laplace's equation. **Applications:** Application of numerical integration to velocity of a particle and volume of solids.	**9L + 2T**	**CO2**
3.	**Statistical Methods and Calculus of Variation:** 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-Problems. Correlation and Regression lines-Problems. Variation of a function and a functional, variational problems, Euler's equation and Isoperimetric problems. **Applications:** Minimal surface of revolution and Hanging cable.	**9L + 2T**	**CO3**
4.	**Fourier series:** Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period $2l$, half range series-Problems. **Applications:** 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-Problems.	**9L + 2T**	**CO4**
5.	**Fourier Transforms:** Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier sine and cosine transforms. **Z - Transform**: Definition, Z-transforms of some standard functions , properties, damping rule, shifting rule(without proof), initial and final value theorems, inverse Z- transforms by partial fractions method. **Applications:** Solving difference equations using Z-transform.	**9L + 2T**	**CO5, 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:

1. CIE- Continuous Internal Evaluation (50 Marks).

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

2. SEE- Semester End Examination (50 Marks).

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

LIFE SKILLS FOR ENGINEERS	
Course Code: 19HSS322	**Credits: 3**
L: T: P : 3:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

Course Outcomes: At the end of the course, the student will be able to:

CO1	Set personal and professional goals
CO2	Develop his critical thinking skills and practise creativity.
CO3	Demonstrate and understanding of personal and professional responsibility
CO4	Apply the concepts of personality development and grooming in real life
CO5	Understand self and work with groups
CO6	Articulate and convey his ideas and thoughts with clarity and focus

Mapping of Course Outcomes to Program Outcomes:

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

Module No.	Module Contents	Hours	COs
1	Goal Setting: Importance of Goals: Creating SMART goals; Critical Thinking and Problem Solving, Six Thinking Hats, Multiple Intelligences and Mind Mapping	6	CO1, CO2
2	Taking Ownership, Being Responsible and Accountable. Meaning of Ownership, Responsibility and Accountability, Practicing these philosophies in course, career and life, Developing a 'Credible Character Impression about self', Self-Motivation, Developing healthy Self-esteem, Leadership	8	CO3
3	Personality Development and Grooming: Expectations from the industry, building personal presence, corporate grooming, corporate etiquettes, Personal branding and image management	6	CO4
4	Self-Awareness and Self-Management: Emotional Intelligence, Knowing your own self- understanding personality, perception, values	8	CO5

	and attitude. Interpersonal skills - Knowing others, working well with others, developing the right attitude for work, being proactive and positive.		
5	Articulation and Group Discussion: Ideas generation, expressing thoughts in a logical flow, presenting views in a group	8	CO6

REFERENCE BOOKS:

1. The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers.
2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.
3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.
4. How to win friends and influence people Dale Carnegie

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Self-Study	Peer Evaluation
Marks (out of 50)	**10**	**15**	**15**	**10**
Remember	-	-	-	-
Understand	-	-	-	-
Apply	5	5	-	5
Analyze	-	-	5	-
Evaluate	-	-	-	
Create	5	10	10	5

SEE- Semester End Examination (50 Marks)

NOTE: Being a Life skills course we felt it would be suitable to do the final assessment through a structured group discussion which will provide an opportunity to test students in all levels of Bloom's Taxonomy.

Bloom's Category	Group Discussion
Remember	**5**
Understand	**10**
Apply	**10**
Analyse	**10**
Evaluate	**5**
Create	**10**

DIGITAL ELECTRONIC CIRCUITS	
Course Code: 19ECE33	**Credits: 3**
L: T: P : 3:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

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

CO1	Describe the fundamental concepts of Digital logic.
CO2	Illustrate the simplification of Boolean expressions using standard methods.
CO3	Employ the simplification methods for designing combinational logic circuits.
CO4	Demonstrate the design of general sequential logic circuits.
CO5	Sketch the circuits of common Registers and Counters by utilizing flip flops.
CO6	Examine the significance of state machines in Digital system design.

Mapping of Course Outcomes to Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECE33	**Digital Electronic Circuits**											
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-
CO6	3	3	3	3	-	1	1	-	-	-	-	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT levels
1	**Principles of Combinational Logic:** Binary Logic functions, pass gates &Logic Gates using nMOS, pMOS and CMOS, DE Morgan's Theorem, Definition of combinational logic, Canonical forms, Generation of switching equations from truth table, Karnaugh maps (3, 4 and 5 variables), Incompletely specified functions(Don't care terms), Map entered Variables (3,4 variables). Realizing functions using MOS Logic. **(Text 1, Chapter 3)**	09	CO1, CO2	L2, L3
2	**Analysis and design of combinational logic:** General Approach to combinational logic, Decoders, Encoders, Priority Encoders, Digital Multiplexers, Adders and Subtractor, Cascading full adders, Look Ahead carry adder, Binary Comparators, Code Conversion, MUX using Pass Gates and Inverters, realization of different logics using 2X1 Multiplexer. **(Text 1, Chapter 4)**	09	CO3, CO6	L1,L2, L3
3	**Sequential Circuits :** Sequential circuit models, Basic Bistable Element, Latches-SR Latch, Application of SR Latch - A Switch Debouncer, S'R' Latch, The gated SR Latch, The gated D Latch, Timing Considerations, FlipFlops- JK Clocked FlipFlops, Clocked T Flipflop, Clocked D Flipflop, The Master-Slave Flip-Flops, Edge Triggered Flip-Flop, Characteristic equations, D Flip Flop using CMOS Pass gates and inverters, Conversion of Flip-Flops. **(Text 2, Chapter 6)**	09	CO4	L1,L3
4	**Simple flip-flop Applications:** Shift Registers: PIPO, SIPO, PISO, SISO, Universal Shift register. Counter: Ripple Counters, synchronous binary counter, Counters based on Shift Registers, Design of synchronous counters- using clocked JK Flip-Flops, clocked D, T, or SR Flip-Flops, Ring counter, Johnson counter. **(Text 2, Chapter 6)**	09	CO4,CO6	L1, L2
5	**Sequential circuit Design:** Moore and Mealy State models, state machine notations, Synchronous Sequential Circuit Analysis, Construction of state diagrams, Sequence detector, counter design, Design of ALU. **(Text 1, Chapter 6)**	09	CO5, CO6	L2, L3, L4

TEXT BOOKS:

1. Digital Logic: Applications and Design, John M. Yarbrough, Cengage Learning, 2015 reprint
2. Digital Principles and Design, Donald D. Givone, 2003,Tata McGraw Hill Edition 2002
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

Mapping of CO v/s PSO:

-	PSO1	PSO2
19ECE33	Digital Electronic Circuits	
CO1	-	-
CO2	-	-
CO3	2	1
CO4	2	1
CO5	2	1
CO6	2	1

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	25	15	10
Remember	5	5	-
Understand	5	5	-
Apply	10	5	5
Analyze	5	-	5
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination Theory (50 Marks)

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

ANALOG ELECTRONIC CIRCUITS	
Course Code: 19ECE34	**Credits: 3**
L: T:P : 3:0:0	**CIE Marks: 50**
Exam Hours: 3	**SEE Marks:50**

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

CO1	Compare the BJT and JFET configurations and their respective biasing methods, to perform the load line analysis.
CO2	Examine the AC model of BJT as well as JFET to perform the small signal analysis, to obtain the gain and impedance of amplifier circuits.
CO3	Distinguish between the equivlanet circuits of BJT as well as JFET configurations, to obtain the frequency response of amplifier circuits.
CO4	Differentiate between the different feedback topologies that are applied to the general amplifier block.
CO5	Employ the positive feedback topology to BJT as well as JFET amplifiers, to obtain the various oscillator circuits.
CO6	Demonstrate the working principles of various types of power amplifiers, using the BJT circuits.

Mapping of Course Outcomes to Program Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
19ECE34	**Analog Electronic Circuits**											
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	2	-	-	-	-	-	-
CO6	3	3	3	3	-	2	-	-	-	-	-	-

Correlation levels: 1-Slight (Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT levels
1	**BJT BIASING AND AC ANALYSIS**: Transistor configurations (CE, CB, CC), Need for Biasing, Load Line(AC and DC) analysis for CE configuration 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. Numerical Examples	**09**	**CO1,CO6**	**L1,L3**
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 for CS configuration. Numerical Examples.	**09**	**CO2**	**L2**
3	**BJT AND JFET FREQUENCY RESPONSE:** Introduction (Logarithms and Decibels), Bode plots, Miller's theorem, Rise time-Bandwidth relationship, Complete hybrid equivalent model ,low and high frequency response of BJT (CE) and FET (CS) amplifiers.	**09**	**CO5,CO6**	**L3,L4**
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 (Colpitts, Hartley), and Crystal Oscillator	**09**	**CO4,CO2**	**L3,L2**
5	**POWER AMPLIFIERS:** Introduction (Amplifier Types and Efficiency), Class A amplifier (Series fed, Transformer coupled), Class B amplifier (Transformer coupled, push-pull),Class AB Complementary Symmetry, Amplifier Distortion, Power Transistor Heat Sinking, Class C and Class D amplifiers	**09**	**CO3**	**L3**

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. Electronics Devices and Circuits , Millman J and Halkias C 3rd edition, 2007, TMH
2. Electric Circuits, (Schaum's Outline Series) by M Nahvi , Joseph Edminister , K Rao , 5th edition, McGraw-Hill Education
3. ONLINE COURSES: MOOC's

Mapping of CO v/s PSO:

COs	PSO1	PSO2
19ECE34	**Analog Electronic Circuits**	
CO1	2	-
CO2	2	-
CO3	2	1
CO4	2	1
CO5	2	1
CO6	2	1

Assessment Pattern

CIE- Continuous Internal Evaluation

Theory (50 marks)

Bloom's Taxonom	Tests	Assignments	Quiz
Marks	**25**	**15**	**10**
Remember	5	5	-
Understand	5	-	5
Apply	5	5	-
Analyze	10	5	5
Evaluate	-	-	
Create	-	-	-

SEE- Semester End Examination Theory (50 Marks)

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

NETWORK ANALYSIS	
Course Code: 19ECE35	**Credits: 3**
L: T:P : 3:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

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

CO1	Solve the electrical networks using mesh and nodal analysis techniques.
CO2	Examine the electrical circuit parameters using network theorems.
CO3	Analyze the steady state and transient response of the electrical circuits.
CO4	Solve for two port network parameters.
CO5	Illustrate the resonance conditions in a series and parallel R-L-C circuit.
CO6	Use Laplace transformation for waveform synthesis.

Mapping of Course Outcomes to Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECE35	**Network Analysis**											
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	3
CO6	3	-	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT levels
1	**Circuit Analysis (AC and DC circuits):** Source Transformation Concept of dependent sources. Network reduction using Delta-Wye Conversion Nodal and Mesh Analysis, concepts of Super Node, Super Mesh. (**Text book 1: Chapter 3)**	**09**	**CO1**	**L1,L2, L3**
2	**Circuit Theorems:** Superposition, Reciprocity, Tellegen's theorem, Thevenin's, Norton's and Maximum power transfer theorems**. (Text book 1: Chapter 9)**	**09**	**CO2**	**L1,L2, L3**
3	**Transient Behavior and Initial conditions:** Behavior of circuit elements under switching condition and their Representation, Evaluation of initial and final conditions in RL and RC and RLC circuits for DC excitations. (**Text book 2: Chapter 5)**	**09**	**CO3**	**L1,L3**
4	**Attenuators:** Nepers and Decibels, Lattice attenuator, T type attenuator, π type attenuator. (**Text book 1: Chapter 11)** **Two-port networks**: two-port parameters of networks: z, y, h and transmission parameters, relationships between 2-port parameters. **(Text book 1: Chapter 12)**	**09**	**CO4**	**L1, L2,L3**
5	**Resonant Circuits**: Series and parallel resonance (with varying frequency), frequency response of series and Parallel circuits, Q –factor, Bandwidth. **(Text book 2: Chapter 5)** **Waveforms synthesis and transient response:** Shifted Unit Step Function, Ramp and Impulse Functions, Waveform Synthesis. **(Text book 1: Chapter 10)**	**09**	**CO5, CO6**	**L2, L3,L4**

TEXT BOOKS:

1. Networks and systems, Roy Choudhury, 2nd edition, 2013, New Age International Publications
2. 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. Electric Circuits, (Schaum's Outline Series) by M Nahvi , Joseph Edminister , K Rao , 5th edition, McGraw-Hill Education

Mapping of CO v/s PSO:

COs	PSO1	PSO2
19ECE35	**Network Analysis**	
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	-
CO5	3	2
CO6	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	**25**	**15**	**10**
Remember	5	5	-
Understand	10	5	5
Apply	5	5	-
Analyze	5	-	5
Evaluate	-	-	-
Create	-	-	-

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: 19ECE36	**Credits: 3**
L: T:P : 2:1:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

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	Use the properties of Fourier analysis for solving complex problems.
CO6	Analyze the discrete time system in Z domain.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
19ECE36	**Signals and Systems**											
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	1	-	-	-	-	-	-	-
CO4	-	3	2	-	-	-	-	-	-	-	-	-
CO5	-	3	2	1	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Sl No.	Contents of Module	Hours	COs	RBT Levels
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, **ELEMENTARY SIGNALS/FUNCTIONS:** Complex exponential, Sinusoidal signals. Unit step, Unit ramp, Unit impulse. **BASIC OPERATION ON SIGNALS:** Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal. **(Text 1, Chapter 1)**	**09**	**CO1**	**L1,L2, L3**
2	**CLASSIFICATION OF SYSTEMS**: Continuous time systems, Discrete time systems, Linear system, Time Invariant system, causal system, Static system ,BIBO system, LTI systems **TIME DOMAIN REPRESENTATION OF LTI SYSTEM:** Convolution, Properties of convolution, Convolution Sum and Convolution Integral for infinite duration sequences, Properties of impulse response representation. **(Text 1, Chapter 2)**	**09**	**CO1** **CO2**	**L1,L2, L3**
3	**DIFFERENTIAL AND DIFFERENCE EQUATION REPRESENTATION OF LTI SYSTEM:** Solution for Differential & Difference equations. **FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS:** Representation of Fourier series, CTFS Properties (No Proof), Dirichlet conditions, Basic problems. **(Text 1, Chapter 2,Chapter 3)**	**09**	**CO3** **CO4**	**L2,L3,L4**
4	**FOURIER TRANSFORM REPRESENTATION OF A SIGNAL:** Deriving Fourier transform from Fourier series, Discrete and continuous Fourier transform & its properties (With Proof), Basic Problems, Fourier transform of periodic signals. **INTRODUCTION TO WAVELET**: Definition, comparison between wavelet transform and Fourier transform. **(Text 1, Chapter 3)**	**09**	**CO4** **CO5**	**L1,L2,L3**
5	**Z-TRANSFORM**: Z transforms, properties of the region of convergence, properties of the Z-transform(No Proof) **INVERSE Z TRANSFORM:** Computation of impulse response, step response, output response of a discrete-time LTI system, Causality and stability, inverse system. Unilateral Z Transform. **(Text 1, Chapter 7)**	**09**	**CO4,** **CO5,** **CO6**	**L3,L4**

TEXT BOOKS

1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, 2007, John Wiley & sons.
2. Soman K P and Ramachandran K I, ―Insight into Wavelets: From Theory to practice, Prentice Hall, 2004

REFERENCE BOOKS:

1. Signals and Systems, Allen V.Oppenheim, Allen S.Willsiky, S. Hamid Nawab, 2015, PHI.

2. Principles of Linear Systems and Signals, B.P.Lathi, 2nd edition, 2009, Oxford University Press.
3. Signals and Systems, Udaykumar S, 6th edition, 2012, Prism book House.

Mapping of CO v/s PSO:

CO	PSO1	PSO2
19ECE36	Signals and Systems	
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2
CO6	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	**25**	**15**	**10**
Remember	5	5	-
Understand	5	5	-
Apply	10	5	5
Analyze	5	-	5
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination Theory (50 Marks)

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

DIGITAL ELECTRONIC CIRCUITS LAB	
Course Code: 19ECL37	**Credits: 1.5**
L:T: P : 0:0:1.5	**CIE Marks: 25**
Exam Hours: 03	**SEE Marks: 25**

Course outcomes: On the completion of this laboratory course, students will be able to:

CO1	Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO2	Design, test and evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and de-multiplexers.
CO3	Design, test and evaluate flips-flops.
CO4	Design and Demonstrate various types of Shift registers, up/down counters, Mealy and Moore model.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECL37	**Digital Electronic Circuits**											
CO1	3	3	3	3	1	2	--	--	2	2	3	2
CO2	3	3	3	3	1	2	--	--	2	2	3	2
CO3	3	3	3	3	1	2	--	--	2	2	3	2
CO4	3	3	3	3	1	2	1	--	2	2	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Sl.no	Laboratory Experiments	COs	RBT levels
1	Simplification of Boolean expressions using K-map and realization of simplified expressions using basic and universal gates **(Text 1, Chapter 3)**	**CO1,CO2**	**L1, L2, L3, L4**
2	Realization of Half/Full adder and Half/Full Subtractor using Logic gates. **(Text 1, Chapter 4)**	**CO1,CO2**	**L3, L4**
3	a) Realization of parallel adder/Subtractors using 7483 chip b) BCD to Excess-3 code conversion and vice versa. **(Text 1, Chapter 4)**	**CO3,CO4**	**L3, L4**
4	Realization of Binary to Gray code conversion and vice versa **(Text 1, Chapter 4)**	**CO3,CO4**	**L3, L4**
5	MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code Converter. **(Text 1, Chapter 4)**	**CO3,CO4**	**L2, L3, L4**
6	Realization of One/Two bit comparator and study of 7485 magnitude comparator. **(Text 1, Chapter 4)**	**CO3,CO4**	**L3, L4**
7	Use of a) Decoder chip to drive LED display and b) Priority encoder. **(Text 1, Chapter 4)**	**CO3,CO4**	**L2, L3, L4**
8	Truth table verification of Flip-Flops: a) JK Master slave b) T type and c) D type. **(Text 2, Chapter 6)**	**C04**	**L2, L3**
9	Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95. **(Text 2, Chapter 6)**	**C03, C04**	**L2, L3**
10	Realization of synchronous and asynchronous counters. (7476, 7490, 74192, 74193) **(Text 2, Chapter 6)**	**C03, C04**	**L2, L3**
11	Realization of Johnson and Ring counter **(Text 2, Chapter 6)**	**C04**	**L2, L3**
12	Design and implementation of synchronous or clocked sequential circuits using Mealy and Moore model. **(Text 1, Chapter 6)**	**C04**	**L2,L3,L4**

TEXT BOOKS:

1. Digital Logic: Applications and Design, John M. Yarbrough, Cengage Learning, 2015 reprint
2. Digital Principles and Design, Donald D. Givone, 2003,Tata McGraw Hill Edition 2002
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

Mapping of CO v/s PSO:

CO	PSO1	PSO2
19ECL37	Digital Electronic Circuits Lab	
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation (25 marks)

Bloom's Taxonomy	Test	Conduction	Viva	Observation	Record
Marks	**25**	**10**	**5**	**5**	**5**
Remember	5	-	-	-	5
Understand	5	5	-	-	-
Apply	10	5	-	5	-
Analyze	5	-	5	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (25 marks)

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

ANALOG ELECTRONICS CIRCUITS LAB	
Course Code: 19ECL38	**Credits: 1.5**
L:T: P : 0:0:1.5	**CIE Marks: 25**
Exam Hours: 03	**SEE Marks: 25**

Course outcomes: On the completion of this laboratory course, students will be able to:

CO1	To understand BJT and JFET amplifier parameters, gain and frequency response and test and analyse the diode application circuits
CO2	To appreciate the switching characteristics of BJT,JFET and MOSFET, test and measure the performance parameters of tuned amplifiers
CO3	To predict the frequency of oscillation of various oscillators and analyse the performance on various parameters
CO4	To compare the theoretical results with the simulated outputs of power amplifiers, BJT feedback amplifiers using simulation tools.

Mapping of Course Outcomes to Program Outcomes:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECL38	**Analog Electronics Circuits Lab**											
CO1	3	2	2	3	-	1	1	1	2	2	1	2
CO2	3	2	2	3	-	1	1	1	2	2	1	2
CO3	3	2	2	3	-	1	1	1	2	2	1	2
CO4	3	2	2	3	-	1	1	1	2	2	1	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Sl.no	Laboratory Experiments	COs	RBT levels
1	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)	**CO1**	**L2**
2	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)	**CO2,CO3**	**L2,L3**
3	1) Wiring of RC coupled Single stage JFET amplifier and Determination of the gain-frequency response, input and output impedances. (Hardwired) 2) Simulation of BJT Darlington Emitter follower with and without bootstrapping and determination of the gain, input and output impedances. (Simulation using Multisim / Pspice).	**CO2,CO4**	**L3,L4**
4	1) 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. 2) Wiring and Testing for the performance of BJT-RC Phase shift Oscillator for 10 KHz. (Hardwired) 3) Testing for the performance of BJT – Hartley & Colpitts Oscillators for RF range. (Hardwired)	**CO3,CO4**	**L3,L4**
5	1) Simulation of a transformer less Class – B push-pull power amplifier and determination of its conversion efficiency. 2) Testing of Class-C tuned amplifier, measurement of conduction angle and calculation of efficiency. (Hardwired)	**CO4**	**L3,L4**

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, 11thedition, 2008, Pearson Education/PHI

REFERENCE BOOKS:

1. Electronics Devices and Circuits , Millman J and Halkias C 3rd edition, 2007, TMH
2. Electric Circuits, (Schaum's Outline Series) by M Nahvi , Joseph Edminister , K Rao , 5th edition, McGraw-Hill Education
3. Lab manuals.

Mapping of CO v/s PSO:

CO	PSO1	PSO2
19ECL38	**Analog Electronic Circuits Lab**	
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	2

Assessment Pattern

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Taxonomy	Test	Conduction	Viva	Observation	Record
Marks	**25**	**10**	**5**	**5**	**5**
Remember	5	5	-	-	-
Understand	10	5	-	-	5
Apply	5	-	5	-	-
Analyze	5	-	-	5	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination

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

MINI PROJECT-I	
Course Code: 19ECL39	**Credits: 2**
L: T:P : 0:0:2	**CIE Marks: 25**
Exam Hours: 03	**SEE Marks: 25**

The student shall be capable of identifying a problem related to the field of Electronics & Communication and carry out a mini project on the problem defined. The developed projects will be reviewed by a panel of experts during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE - Continuous Internal Evaluation (25 Marks)

Bloom's Taxonomy	**Mini Project**
Marks (Out of 25)	**-**
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE – Semester End Examination (25 marks)

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

FOURTH SEMESTER

(SYLLABUS)

APPLIED MATHEMATICS – IV	
Course Code: 19ECE41	**Credits: 3**
L: T: P : 2:1:0	**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 initial value problems using appropriate numerical methods
CO2	Understand the concepts of Complex variables to solve Engineering Problems
CO3	Understand the concepts of Transformations, Complex integration, Poles and Residuals in the stability analysis of engineering problems
CO4	Gain ability to use probability distributions to analyze and solve real time problems
CO5	Apply the concept of sampling distribution to solve engineering problems
CO6	Use the concepts to analyze the data to make decision about the hypothesis

Mapping of Course Outcomes to Program Outcomes:

	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

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**CO's**
1.	**Numerical Methods:** Numerical solution of ordinary differenti equations of first order and of first degree: Modified Euler's metho and Runge-Kutta method of fourth-order-Problems. Milne's predicto and corrector methods-Problems. Numerical Solutions of second order ordinary differential equations by Runge-Kutta method of fourth-order-Problems.	**9L + 2T**	**CO1**

2.	**Complex Variables**: Functions of complex variables, Analytical functions, Cauchy-Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions-Problems using Milne-Thompson's method. **Applications:** Flow problems-Velocity potential, Stream functions and complex potential functions.	**9L + 2T**	**CO2**
3.	**Conformal Transformations and Complex Integrations:** $w = z^2$, $w = e^z$ and $w = z + (1/z)$. Cauchy's Theorem (with proof). Singularities, Poles and Residues, Residue theorem (without proof)-Problems.	**9L + 2T**	**CO3**
4.	**Probability distributions:** Random variables (discrete and continuous), probability density functions. Discrete Probability distributions: Binomial and Poisson distributions-Problems. Continuous Probability distributions: Exponential and Normal distributions-Problems. **Joint Probability distributions:** Mathematical expectation, correlation, covariance (discrete random variables only)-Problems.	**9L + 2T**	**CO4**
5.	**Sampling Theory:** Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, confidence limits for means, Student's t-distribution, F-distribution and Chi-square distribution for test of goodness of fit for small samples.	**9L + 2T**	**CO5, 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:

3. CIE- Continuous Internal Evaluation (50 Marks).

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

4. SEE- Semester End Examination (50 Marks).

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

ECONOMICS FOR ENGINEERS	
Course Code: 19HSS421	**Credits: 2**
L: T: P : 2:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

Course Outcomes: On completion of the course, the student will be able to:

CO1	Understanding the knowledge of economics and its importance in business decisions.
CO2	Application of micro economic concept in business.
CO3	Analyze different cost elements in terms of a project.
CO4	Evaluation of a project using various methods of capital budgeting.
CO5	Understand the process of accounting transactions.

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	3	1	3	2	2	1	1	3	2
CO2	1	2	3	3	1	3	2	2	1	1	3	2
CO3	1	2	3	3	1	3	2	2	1	1	3	2
CO4	1	2	3	3	1	3	2	2	1	1	3	2
CO5	1	2	3	3	1	3	2	2	1	1	3	2

Module No.	Contents of Module	Hours	Cos
1	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).	7	1
2	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.	7	2
3	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,	7	3

	Administrative Over-Heads.		
4	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 loans and EMI Payment. Present worth, Future worth.	8	4
5	Book Keeping and Accounts: Journal, Ledger, Trial balance, asset Types, profit & loss account, balance sheet.	8	5

TEXT BOOKS:

1. Riggs J.L, Engineering Economy, TMH, 2012 edition
2. Jain T.R., Economics for Engineers, VK Publications,2008 Edition
3. IM PANDEY, Finacial Management, Vikas Pub. House, 2018 Edition
4. D N Dwivedi, MangerialEconomics ,Vikas Pub. House, 2018 Edition
5. Dr.A.R Sainath, Sasikala Devi, Engineering Economics and Financial Accounting, Charulatha Publications,2015 edition

REFERENCE BOOKS:

1. Thuesen H.G, Engineering Economy. PHI,1984
2. Prasanna Chandra, Financial Mangement,TMH,2007
3. Singh Seema, Economics for Engineers, IK International,2014
4. Chopra P. N, Principle of Economics, Kalyani Publishers,2012
5. Dewett K K, Modern Economic Theory, S. Chand,2006

Assessment pattern

CIE - Continuous Internal Evaluation (25 Marks, Theory)

Bloom's Category	**Test**	**Assignment**	**SSR**
Marks (out of 50)	**10**	**7.5**	**7.5**
Remember	2.5		
Understand	2.5		
Apply	2.5		
Analyze	2.5	2.5	2.5
Evaluate		2.5	2.5
Create		2.5	2.5

SEE – Semester Ending Examination (25 Marks)

Bloom's Category	**SEE Theory (25)**
Remember	10
Understand	5
Apply	5
Analyze	5
Evaluate	
Create	

ENVIRONMENTAL SCIENCE AND AWARENESS	
Course Code: 19HSS423	**Credits: 0**
L:T: P : 0:0:0	**CIE Marks: 25**
Exam Hours: 2	**SEE Marks: 25**

Course Outcomes: At the end of the Course, the student will be able to:

CO1	Understand the concepts of environment, ecosystem, biodiversity and its interdependence on human life.
CO2	Develop an insight on types of natural resources and the concept of sustainable development.
CO3	Understand the different control measures of pollution and importance of waste management.
CO4	Think and apply technology as a solution for environment related concerns, keeping in view the different environmental acts and amendments.

Mapping of Course Outcomes to Program Outcomes:

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

Module No.	Content of Module	Hrs	COs
1	**Introduction to Environment, Ecosystem and biodiversity:** Environment - Components of Environment, Scope and importance of Environmental studies, Ecosystem: Types & Structure of Ecosystem, Energy flow in the ecosystem, Food chains – food webs & ecological pyramids. Biodiversity – Definition, Hot-spots of biodiversity, Threats to biodiversity, Conservation of biodiversity.	05	CO1
2	**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems. Role of an individual in conservation of natural resources. Water conservation, rain water harvesting. Balanced use of resources for sustainable lifestyle – strategies.	04	CO2
3	**Environmental Pollution:** Definition, Causes, effects and control measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal Pollution and Nuclear hazards. Role of an individual in prevention of pollution - Waste management – urban and industrial wastes.	04	CO3

4	**Social Issues and Environment:** Environmental ethics – issues and possible solutions. Environment protection act – Air (prevention and Control of pollution) act & Water (prevention and Control of pollution) act. Role of government: Swatch Bharat Abhiyan, National Mission for Clean Ganga (NMCG), River rejuvenation, Role of Non-governmental Organizations (NGOs), Global warming and climate change.	04	CO3 CO4
5	**Human Population and Environment:** Population growth & explosion, Family welfare programme. Environment and human health, Human rights, Value education. Role of Technology in protecting environment and human health.	05	CO4

Text Books:

1. "Environmental Studies: Basic Concepts" by Ahluwalia, V. K. . The Energy and Resources Institute (TERI) Publication, 2nd edition, 2016. ISBN: 817993571X, 9788179935712.
2. "Textbook of Environmental Studies for Undergraduate Courses of all branches of Higher Education" by Bharucha, Erach for UGC, New Delhi, 2004. ISBN: 8173715408, 9788173715402.

Reference Books:

1. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, Mausam Verma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
2. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
3. Environmental Science- Working with the earth by G Taylor Miller Jr, Brooks Cole Thompson Publications, 10 thEdition. ISBN: 10: 0534424082.
4. Elements of Environmental Science and Engineering by P. Meenakshi, Prentice Hall of India Pvt. Ltd, 2005 Edition. ISBN: 8120327748, 9788120327740.

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests	Assignments	Quiz
Marks (out of 50)	**15**	**05**	**05**
Remember	5	2	2
Understand	5	2	2
Apply	5	1	1
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

SEE – Semester End Examination (25 Marks)

Bloom's Category	Tests
Remember	10
Understand	10
Apply	5
Analyze	0
Evaluate	0
Create	0

SYSTEM DESIGN USING HDL	
Course Code: 19ECE43	**Credits: 3**
L: T:P : 3:0:0	**CIE Marks: 50**
Exam Hours: 3	**SEE Marks: 50**

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

CO1	Recognize the importance of HDL for the automation of VLSI design.
CO2	Employ VHDL and / or Verilog data types and operators for describing the electronic hardware.
CO3	Examine the usage of various types of assignments in Verilog.
CO4	Identify the need of synthesis in the implementation of HDL.
CO5	Write Verilog code for the design of specific applications.
CO6	Distinghish between the commonly used programmable devices.

Mapping of Course Outcomes to Program Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
19ECE43	**System Design Using HDL**											
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-
CO6	3	3	3	2	-	1	-	-	-	-	1	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT levels
1	**INTRODUCTION TO VHDL:**A brief history of HDL, Structure of HDL module, Operators, Data types, Types of Descriptions(Behavioral, structural, Data-flow), Procedures and functions**(Text 1 - chapter 1,6)**	**09**	**CO1, CO2, CO3**	**L1,L2, L3**
2	**INTRODUCTION TO VERILOG:** Computer-Aided Design, Hardware Description Languages, Verilog Data Types and Operators, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments**(Text 2 – chapter 2)**	**09**	**CO1, CO2, CO3**	**L1,L2, L3**
3	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, Behavioral and Structural Verilog. Brief comparison of VHDL and Verilog. **(Text 2 – chapter 2)**	**09**	**CO1, CO2, CO3**	**L1,L2, L3,L4**
4	**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 **(Text 2 – chapter 2,8)** **DESIGN EXAMPLES:** BCD to 7-Segment Display Decoder. A BCD Adder. 32-Bit Adders, Array Multiplier**. (Text 2 – chapter 4)**	**09**	**CO3, CO5**	**L2, L3**
5	**INTRODUCTION TO PROGRAMMABLE LOGIC DEVICES AND DESIGNING WITH FPGA:** 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, Implementing Functions in FPGAs, Design Translation (synthesis), Mapping, Placement and Routing**. (Text 2 – chapter 3,6)**	**09**	**CO4,C06**	**L2, L3**

TEXT BOOKS:

1. HDL Programming (VHDLandVerilog), Nazeih M. Botros, 2015, John-Weily India Pvt. Ltd
2. Digital System design UsingVerilog, Charles H. RothJr., Lizy Kurian John, Byeong Kil Lee, 1st Edition, 2015, CL Engineering.

REFERENCE BOOKS:

1. Digital Systems Design using VHDL, Charles H Roth, Jr., 2007, Thomson
2. Digital Design:An Embedded Systems approach Using VERILOG, Peter J. Ashenden, 2014, Elesvier

Mapping of CO v/s PSO:

COs	PSO1	PSO2
19ECE43	System Design Using HDL	
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2
CO6	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	25	15	10
Remember	5	-	5
Understand	5	5	-
Apply	10	5	5
Analyze	5	5	-
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination Theory (50 Marks)

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

DIGITAL SIGNAL PROCESSING	
Course Code: 19ECE44	**Credits: 3**
L: T:P : 3:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

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

CO1	Apply the knowledge of fourier analysis to compute Discrete Fourier Transforms of signals.
CO2	Use the concept of convolutional operators for linear filtering techniques.
CO3	Determine the DFT and inverse DFT using Fast Fourier Transform algorithms
CO4	Design the digital filters to obtain the desired response.
CO5	Understand the basic features of programmable Digital Signal Processor.
CO6	Appraise the different applications of DSP

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECE44	Digital Signal Processing											
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	3	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	-	3	2	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	1	3	-	-	-	1	1	-	1

Correlation levels: 1- Less (Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT
1	**Introduction to Signal Processing and Discrete Fourier Transforms (DFT):** Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, Properties of DFT. (Refer Text 1, chapter 7- 7.1, 7.2)	09	CO1, CO2	L1,L2, L3,L4
2	**Circular Convolution:** Circular convolution, Use of DFT in linear filtering, overlap-save and overlap-add method, Direct computation of DFT. (Refer Text 1, chapter 7- 7.3) **FFT algorithm:** 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. (Refer Text 1, chapter 8- 8.1.1, 8.1.3)	09	CO3	L2,L3, L4
3	**Design and Realization of FIR Filters:** Introduction, FIR filter design: Introduction to FIR filters, Design of FIR filters using -Rectangular, Hamming, Bartlet and Kaiser windows, Structures for FIR filters systems (Direct Form). (Refer Text 1: Chapter 9- 9.2.1, Chapter 10 - 10.2.1, 10.2.2)	09	CO4, CO6	L2,L3
4	**Design and Realization of IIR Filters:** Introduction, IIR filter design:Butterworth and Chebyshev filters, analog to analog frequency transformations, Mapping of transfer functions: Impulse Invariance method and Bilinear transformation, Structures for IIR filters (Direct Form 1, Direct Form 2, cascade and parallel) (Refer Text 1: Chapter 9- 9.3.1,9.3.3, 9.3.4, Chapter 10 - 10.3.2, 10.3.3, 10.3.4, 10.4.1)	09	CO4, CO6	L2,L3
5	**An Introduction to Programmable Digital Signal Processor:** DSP system, Features of Digital Signal Processors, Basic Architectural features, Number formats: Fixed point and Floating point formats, Q notation. (Refer Text 2: 1.1, 1.2,1.3, 3.2.1, 3.2.3, 4.2, 7.2) **Applications of DSP:** Digital Processing of audio signals, Radar signal Processing, DSP based measurement system. (Refer Text 3: chapter 10 - 10.8, 10.9, 10.10)	09	CO5, CO6	L1,L2, L3

TEXT BOOKS:

1. Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4th Edition, 2014, Pearson education.

2. Digital Signal Processing, Avtar Singh& S. Srinivasan, Thomson Brooks/Cole

3. Digital Signal Processing, P. Ramesh Babu, 6th Edition, 2014, Scitech Publications.

REFERENCE BOOKS:

1. Discrete Time Signal Processing, Oppenheim & Schaffer,7th Edition, 2010,TMH.

2. Digital Signal Processing, S. K. Mitra, 4th Edition, 2014, Tata Mc-Graw Hill.

Mapping of CO v/s PSO:

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2
CO6	3	2

Assessment Pattern
CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	**Tests**	**Assignments**	**Quizzes**
Marks	**25**	**15**	**10**
Remember	**5**	**-**	**-**
Understand	**10**	**-**	**5**
Apply	**10**	**7.5**	**5**
Analyze	**-**	**7.5**	**-**
Evaluate	**-**	**-**	**-**
Create	**-**		**-**

SEE- Semester End Examination Theory (50 Marks)

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

CONTROL SYSTEMS	
Course Code: 19ECE45	**Credits: 3**
L: T:P : 2:1:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

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

CO1	Apply various mathematical principles to derive transfer function and state space model for a given system
CO2	Apply the transfer function concepts to develop the Mathematical Models for electrical and mechanical systems
CO3	Analyze transient and steady state response of first order and second order systems for standard test input signals
CO4	Examine the absolute and relative system stability in S-Domain
CO5	Analyze the stability of the system using frequency response specifications
CO6	Solve state equations based on the concepts of state model..

Mapping of Course Outcomes to Program Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
19ECE45	**Control Systems**											
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	3	-	-	-	-	-	-	-
CO3	3	3	-	-	3	-	-	-	-	-	-	3
CO4	-	3	-	2	3	-	-	-	-	-	-	3
CO5	-	3	-	2	3	-	-	-	-	-	-	-
CO6	3	-	-	-	3	-	-	-	-	-	-	3

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	Module Contents	Hours	COs	RBT levels
1	**Introduction:** The control system, Concept of Open loop and Closed loop systems, Different examples and applications of open loop and closed loop control systems, Feed-Back Characteristics, Effects of feedback. Mathematical modeling of Physical systems: Transfer function, Representation of physical systems by differential equations, Modeling of Electric systems, Translational and rotational mechanical systems, Analogous systems, Determination of transfer function by block diagram reduction techniques and signal flow method using Mason's gain formula	**09**	**CO1, CO2**	**L1,L2 L3**
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. Proportional derivative, proportional integral and proportional derivative and integral systems.(Excluding design) **Text Book 1-Chapter5**	**09**	**CO3**	**L1,L2 L3**
3	**Stability Analysis in S-Domain**: The concept of stability, Necessary conditions for stability, Hurwitz stability criterion, Routh stability criterion and its applications, Relative stability analysis **Text Book1**- Chapter 6 **The Root Locus Technique:** The root locus concepts - construction of root loci. **Text Book1**- Chapter 7	**09**	**CO4,CO5**	**L2,L3 L4**
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.(excluding design) **Text Book1**- Chapter 8 **Text Book1**- Chapter 9	**09**	**CO4,CO5**	**L2,L3 L4**
5	**State Space Analysis of Continuous Systems:** Concept of state, state variables and state model, State models for Linear continuous time systems (SISO,) – derivation of transfer function from state models and vice versa, Diagonalization-Solution of state equations – state transition matrix and its properties, Controllability and Observability **Text Book1**- Chapter 12(excluding Caylay-Hamilton Theorem)	**09**	**CO1, CO6**	**L1,L2, L3,**

TEXT BOOKS:

1. Control Systems Engineering, Nagrath I. J. and M. Gopal, 6th Edition, 2018, New Age Publications.
2. Control System Engineering, Norman S. Nise, 5th Edition, 2009, Wiley.

REFERENCE BOOKS:

1. Modern Control Engineering, Ogata Katsuhiko, 5th Edition, 2010, PHI,
2. B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003.

Mapping of CO v/s PSO:

COs	PSO1	PSO2
19ECE45	Control Systems	
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2
CO6	2	2

Assessment Pattern

CIE- Continuous Internal Evaluation Theory (50 marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks	**25**	**15**	**10**
Remember	10	5	5
Understand	10	5	5
Apply	-	-	
Analyze	5	5	-
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination Theory (50 Marks)

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

LINEAR INTEGRATED CIRCUITS	
Course Code: 19ECE46	**Credits: 3**
L: T:P : 3:0:0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**

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

CO1	Outline the basic operational amplifier's parameters .
CO2	Explain the DC and AC characteristics of operational amplifiers.
CO3	Build various linear and non linear analog circuits using operational amplifiers.
CO4	Analyze Switching circuits, signal processing and signal converting circuits using operational amplifiers
CO5	Dissect filter circuits using operational amplifiers.
CO6	Analyze the behaviour of timer IC and other linear IC's.

Mapping of Course Outcomes to Program Outcomes:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
ECE46	**Linear Integrated Circuits**											
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	2	-	-	-
CO6	3	3	3	3	3	-	-	-	2	-	-	1

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs	RBT levels
1	**OPERATIONAL AMPLIFIER FUNDAMENTALS**: Basic OpAmp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate, Frequency limitations. **Op-Amps as DC Amplifiers**-Direct coupled – Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.	09	CO1 CO2	L1, L2, L3
2	**OP-AMP AS AC AMPLIFIERS**- Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, and Capacitor coupled Inverting amplifiers. High input impedance - Capacitor coupled Voltage Follower, setting the upper cut-off frequency, Use of a single polarity power supply	09	CO2, CO3, CO4	L2, L3
3	**OP-AMP APPLICATIONS :** Voltage sources, current sources, Integrator and differentiator, Log and antilog amplifiers, Analog Multiplier and Divider, Instrumentation amplifier, Precision rectifiers, Limiting Circuits, Sample and hold circuits, Zero crossing detectors, Inverting Schmitt trigger circuits.	09	CO3, CO4	L3, L4
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, Voltage regulators using IC 78XX and 79XX, 723 general purpose regulator, Switching regulator	09	CO5, CO4	L1, L2, L3
5	**OTHER IC APPLICATIONS**: 555 Timer and its different circuit applications as Astable & Monostable multivibrator, **PHASE LOCKED LOOP** -operating principles, Phase detector / comparator, LM566 VCO **DAC and ADC converters** - DAC using R2R, ADC using SAR and counter type.	09	CO6	L2, L3, L4

TEXT BOOKS:

1. Operational Amplifiers and Linear IC's, David A. Bell, 3 rd edition, 2011, Oxford University Press.

2. Linear Integrated Circuits, D. Roy Choudhary and Shail B. Jain, 4 th edition, 2015, New Age International.

3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, 2015, Pearson.

REFERENCE BOOKS:

1. Op amps - Design, Applications and Troubleshooting, Terrell, 3rd edition, 2006, Elsevier.

2. Operational Amplifiers, George Clayton and Steve Winder, 5th edition, 2008, Elsevier.

3. Operational Amplifiers and Linear Integrated Circuits, Robert. F. Coughlin & Fred F. Driscoll, 2006, PHI/Pearson.

4. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, 3rd edition, 2005, TMH.

Mapping of CO v/s PSO:

COs	**PSO1**	**PSO2**
19ECE46	**Linear Integrated Circuits**	
CO1	**2**	**--**
CO2	**2**	**--**
CO3	**2**	**--**
CO4	**2**	**2**
CO5	**2**	**--**
CO6	**2**	**2**

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	-

Hardware Description Language Lab	
Course Code: 19ECL47	**Credits: 1.5**
L: T:P : 0:0:1.5	**CIE Marks: 25**
Exam Hours: 3	**SEE Marks: 25**

Course outcomes: On the completion of this laboratory course, students will be able to:

CO1	Write the Verilog /VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
CO2	Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
CO3	Design and verify the functionality of digital circuit/system by writing test benches
CO4	Program FPGAs to synthesize the digital designs.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19ECL47	**System Design Using HDL**											
CO1	3	3	3	3	1	1	-	-	2	2	1	2
CO2	3	3	3	3	1	1	-	-	2	2	1	2
CO3	3	3	3	3	1	1	-	-	2	2	1	2
CO4	3	3	3	3	1	1	1	1	2	2	1	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Sl.no	Laboratory Experiments	COs	RBT levels
1	Write an HDL code to realize all logic gates. **(Text1 – chapter 1, Text2- chapter2)**	**CO1,CO3**	**L1, L2, L3**
2	Write an HDL code to describe the functions of a Full Adder using three modeling styles. **(Text1 – chapter 1, Text2- chapter2)**	**CO1,CO3**	**L1, L2, L3**
3	Write a model for 16 bit ALU using the 4bit opcodes; the requisite functions can be defined for the chosen opcodes. **(Text1 – chapter 1, Text2- chapter2)**	**CO1,CO3**	**L1, L2, L3**
4	Write an HDL program for the following designs: a. Decoder b. Encoder (without priority and with priority c. Multiplexer and De multiplexer **(Text1 – chapter 1, Text2- chapter2)**	**CO1,CO3**	**L1, L2, L3**
5	Write an HDL program for the following designs: a. 4 bit Binary to Gray converter b. 4-bit Binary Comparator **(Text1 – chapter 1, Text2- chapter 2)**	**CO1,CO3**	**L1, L2, L3**
6	Develop the HDL code for the following flipflops: T, D, SR, JK. **(Text1 – chapter 1, Text2- chapter 2)**	**CO2,CO3**	**L1, L2, L3**
7	Design 4bit Binary and BCD counters (Synchronous reset and Asynchronous reset and "any sequence" counters). **(Text1 – chapter 1, Text2- chapter 2)**	**CO2,CO3**	**L1, L2, L3**
8	Synthesize the code of above experiments and generate gate level netlist. **(Text2- chapter 2)**	**CO4**	**L2, L3,L4**
9	Synthesize the code of above experiments and generate gate level netlist. **(Text2- chapter 2)**	**CO3,CO4**	**L2, L3,L4**
10	Write an HDL code to display messages on the given seven segment display **(Text2- chapter 2,3,6)**	**CO3,CO4,**	**L2,L3,L4**
11	Write the HDL code to control speed, direction of dc and stepper motor	**CO3,CO4**	**L2, L3,L4**

	(Text2- chapter 2,3,6)		
12	Write the HDL code to generate different waveforms (sawtooth, sine wave, square, triangle, ramp etc) using DAC and FPGA kit **(Text2- chapter 2,3,6)**	**CO4,**	**L2,L3,L4**

TEXT BOOKS:

1. HDLProgramming(VHDLandVerilog),NazeihM.Botros,2015,John-WeilyIndiaPvt.Ltd
2. DigitalSystemdesignUsingVerilog,CharlesH.RothJr.,LizyKurianJohn,ByeongKilLee,1st Edition, 2015, CL Engineering.

REFERENCE BOOKS:

1. Digital Systems Design using VHDL, Charles H Roth, Jr., 2007, Thomson
2. Digtal Design:An Embedded Systems approach Using VERILOG, Peter J. Ashenden, 2014, Elesvier.

Mapping of CO v/s PSO:

CO	**PSO1**	**PSO2**
19ECL47	**System Design using HDL Lab**	
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Taxonomy	Test	Conduction	Viva	Observation	Record
Marks	**25**	**10**	**5**	**5**	**5**
Remember	5	-	-	-	5
Understand	5	5	-	-	-
Apply	10	5	5	-	-
Analyze	5	-	-	5	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (25 Marks)

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

DIGITAL SIGNAL PROCESSING LAB	
Course Code: 19ECL48	**Credits: 1.5**
L: T:P : 0:0:1.5	**CIE Marks: 25**
Exam Hours: 03	**SEE Marks: 25**

Course outcomes: On the completion of this laboratory course, students will be able to:

CO1	Represent and Visualize the signals in Time domain and Frequency domain, and compute the output of the LTI system using Convolution.
CO2	Design and realize FIR and IIR filters for the desired frequency response and compare signals using the concept of Correlation.
CO3	Implement discrete computations using DSP processor.
CO4	Realize digital filters using a simulation tool and analyze the response of the filter for an audio signal.

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
19ECL48L	**Digital Signal Processing laboratory**											
CO1	3	2	3	2	3	1	-	1	1	-	1	2
CO2	3	2	3	2	3	1	-	-	1	-	1	2
CO3	3	2	3	2	3	1	1	-	1	-	1	2
CO4	3	2	3	2	3	1	1	-	1	-	1	2

Correlation levels: 1- Less (Low) 2-Moderate(Medium) 3-Substantial(High)

Sl.no	**Laboratory Experiments**	**COs**	**RBT levels**
1	**LIST OF EXPERIMENTS USING MATLAB** **1.** Computation of N point DFT of a given sequence and to plot Magnitude and phase spectrum. 2. Linear convolution of two sequences using time domain and DFT/ IDFT 3. Circular convolution of two given sequences using time domain DFT/IDFT	**CO1,CO2, CO3,CO4**	**L2, L3, L4**

	4. Autocorrelation of two sequences using time domain and DFT /IDFT 5. Cross correlation of two sequences using time domain and DFT/ IDFT **6.** Matlab code for implementing Goertzel algorithm 7. 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 **8.** Design and implementation of FIR filters to meet given specifications		
2	**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. **3.** Linear convolution of two given sequences. **4.** Circular convolution of two given sequences. **5.** Application of FIR filters for Audio applications- To plot time and frequency (Spectrum) display of Microphone output using DSP. **6.** Realization of an FIR filter (any type) to meet given specification. The input can be a signal from function generator / speech signal.	**CO4**	**L3,L4**
3	**LIST OF EXPERIMENTS USING SIMULINK** **c)** Sampling of a signal **d)** Computation of N- Point DFT of a given sequence. **e)** Design of IIR filter of different types (Butterworth and chebyshev: low pass, high pass, band pass and band reject) to meet given specifications. f) Design of FIR filter to meet given specifications.	**CO4**	**L3,L4**

TEXT BOOKS:

1. Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4th Edition, 2014, Pearson education.

2. Digital Signal Processing, P. Ramesh Babu, 6th Edition, 2014, Scitech Publications.

REFERENCE BOOKS:

1. Discrete Time Signal Processing, Oppenheim & Schaffer, 7th Edition, 2010, TMH.

2. Digital Signal Processing, S. K. Mitra, 4th Edition, 2014, Tata Mc-Graw Hill.

Mapping of CO v/s PSO:

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Assessment Pattern

CIE- Continuous Internal Evaluation (25 marks)

Bloom's Taxonomy	**Test**	**Conduction**	**Viva**	**Observation**	**Record**
Marks	**25**	**10**	**5**	**5**	**5**
Remember	5	-	-	-	-
Understand	5	5	-	-	-
Apply	10	5	5	5	5
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

SEE- Semester End Examination (25 marks)

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

MINI PROJECT-II	
Course Code: 19ECL49	**Credits: 2**
L: T:P : 0:0:2	**CIE Marks: 25**
Exam Hours: 03	**SEE Marks: 25**

The student shall be capable of identifying a problem related to the field of Electronics & Communication and carry out a mini project on the problem defined. The developed projects will be reviewed by a panel of experts during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	**Mini Project**
Marks (out of 25)	
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE- Semester End Examination (25 Marks)

Blooms Category	**Tests**
Marks (out of 25)	
Remember	-
Understand	-
Apply	15
Analyze	-
Evaluate	10
Create	-

BASIC APPLIED MATHEMATICS-I	
Course Code: 19DMAT31	**Credits: 0**
L:T: P : 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:

	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

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**CO's**
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)-Problems.	**5L**	**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.	**5L**	**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.	**5L**	**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.	**5L**	**CO5**
5.	**Linear Algebra-2:** Linear transformation, Eigen values and Eigen vectors, diagonalisation of a square matrix-Problems.	**5L**	**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:

1. 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	-	-

2. 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	-

BASIC APPLIED MATHEMATICS-II	
Course Code: 19DMAT41	**Credits: 0**
L:T:P : 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:

	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

Course Syllabus			
Module No.	**Contents of the Module**	**Hours**	**CO's**
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.	**5L**	**CO1**

2.	Vector Differentiation: Velocity and Accelerations, Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of a vector function- Problems. Solenoidal and irrotational vector fields-Problems.	**5L**	**CO2**
3.	Linear differential equations with constant coefficients: Solution of initial and boundary value problems, Inverse differential operator techniques for the functions-e^{ax}, $\mathrm{Sin}\,(ax+b)$ and $\mathrm{Cos}\,(ax+b)$.	**5L**	**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.	**5L**	**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.	**5L**	**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:

1. 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	-	-

2. 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.

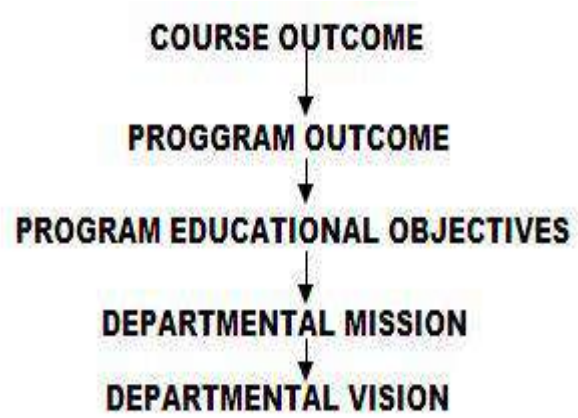
There are three educational Outcomes as defined by the National Board of Accreditation:

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 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 by straightforward 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.