Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2022-23

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

(Effective from the academic year 2022-23)

Programme:B.Tech: Electronics and Communication Engineering

III SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BS	22MATE31	Mathematics for EES-III	Mathematics	3			3	50	50	100	03
2	PCC	22EC32	Analog Circuits	ECE	3	1		3	50	50	100	04
3	PCC	22EC33	Digital System Design	ECE	3			3	50	50	100	03
4	PCC	22EC34	Network Analysis	ECE	3			3	50	50	100	03
5	PCC	22EC35	Sensors and Actuators	ECE	3			3	50	50	100	03
6	PCC	22ECL36	Analog Circuits Laboratory	ECE			2	3	50	50	100	01
7	PCC	22ECL37	Digital System Design Laboratory	ECE			2	3	50	50	100	01
8	PCC	22ECL38	Network Analysis Laboratory	ECE			2	3	50	50	100	01
9	PW	22PRJ39	Project-III	ECE			2	3	50	50	100	01
10	HSS	22HSM310B	Soft Skills	Humanities	1			3	50	50	100	01
11	AEC	22AEC311X	Ability Enhancement Course-III	ECE			2	3	50	50	100	01
Total					**16**	**1**	**10**	**33**	**550**	**550**	**1100**	**22**

Note: BS-Basic Science, PCC- Programme Core Course, PW-Project Work, AEC- Ability Enhancement Course, HSS-Humanity and Social Science, NCMC-Non Credit Mandatory Course

Project(PRJ): A batch of 4 students (Same branch or different branches) with a guide, may undertake one project.

Ability Enhancement Course-3												
Course code under 22AEC311X			**Course Title**									
22AEC311A			Analog Electronics Laboratory using Pspice/Mutlisim / Ltspice									
22AEC311B			Digital System Design Laboratory using Pspice/Multisim / Ltspice									
Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
12	NCMC	22MATDIP31	Additional Mathematics– I	Mathematics	2	-	-	-	100	00	100	00

1) Non Credit Mandatory Courses (NCMC) Additional Mathematics-I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of B. Tech. programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the university examination. In case any student fails to secure the minimum 50% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s.
2) These course shall not be mandatory for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to B.Tech. programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other universities to fifth semester are required to earn 50 activity points from the year of entry to Sharnbasva University. The Activity Points earned shall be reflected on the students eighth semester Grade card.

The activities can be spread over the years, any time during the semester weekend holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours requirement should be fulfilled. Activity Points (non credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity points, Eighth semesterGradeCardshallbeissuedonlyafterearningtherequiredactivitypoints.

Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2022-23

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

(Effective from the academic year 2022-23)

Programme: B.Tech.: Electronics and Communication Engineering

IV SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BS	22MATE41	Mathematics for EES-IV	Mathematics	3			3	50	50	100	03
2	PCC	22EC42	Analog and Digital Communication	ECE	3			3	50	50	100	03
3	PCC	22EC43	Microcontroller	ECE	3			3	50	50	100	03
4	PCC	22EC44	Signals and Systems	ECE	3			3	50	50	100	03
5	PCC	22EC45	Information Theory and Coding	ECE	3			3	50	50	100	03
6	PCC	22ECL46	Analog and Digital Communication Laboratory	ECE			2	3	50	50	100	01
7	PCC	22ECL47	Microcontroller Laboratory	ECE			2	3	50	50	100	01
8	PCC	22ECL48	Signals and Systems Laboratory	ECE			2	3	50	50	100	01
9	PW	22PRJ49	Project-IV	ECE			2	3	50	50	100	01
10	HSS	22UHV410	Universal Human Values	Humanities	2	1		3	50	50	100	03
11	AEC	22AEC411X	Ability Enhancement Course-IV	ECE			2	3	50	50	100	01
Total					**17**	**1**	**10**	**33**	**550**	**550**	**1100**	**23**

Note: BS-Basic Science, PCC- Programme Core Course, PW-Project Work, AEC- Ability Enhancement Course, HSS-Humanity and Social Science, NCMC-Non Credit Mandatory Course, OC-Online Course.

Project(PRJ): A batch of 4 to 5 students (Same branch or different branches) with a guide, may undertake one project (1 hour of theory/tutorial or two hours of practice /activities.

Ability Enhancement Course-4												
Course code under 22AEC411X				**Course Title**								
22AEC411A				Embedded C Basics								
22AEC411B				PCB Design and Fabrication								
Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
12	NCMC	22MATDIP41	Additional Mathematics–II	Mathematics	2	-	-	-	100	00	100	00

1) Non Credit Mandatory Courses (NCMC) Additional Mathematics-I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of B. Tech. programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the university examination. In case any student fails to secure the minimum 50% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s.
2) These courses shall not be mandatory for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to B.Tech. programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, every regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other universities to fifth semester are required to earn 50 activity points from the year of entry to Sharnbasva University. The Activity Points earned shall be reflected on the students eighth semester Grade card.

The activities can be spread over the years, anytime during the semester weekends holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours requirement should be fulfilled. Activity Points (non credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity points, Eighth semester Grade Card shall be issued only after earning the required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

Engineering Mathematics – III For ECE & EEE Branch			
Course Code:	22MATE31	CIE Marks	50
Contact Hours/Week	03	SEE Marks	50
Total Hours	40	Exam Hours	03
Semester	III	Credits	03

Course Learning Objectives:

This course will enable students to:

- Introduce most commonly used analytical and numerical methods in the different engineeringfields.
- Learn Laplace transform and Z-transforms to solve ODE and PDE's.
- Understanding the statistical methods, numerical methods.
- Solve the problem related to Interpolation.
- To discuss the random variable and associated probability distributions.

Understand the vector space and associated results.

MODULE-1: Probability Distribution

Probability Distribution: Random variables (discrete and continuous) probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and Normal distributions. Problems.

Self Study : Definition of probability , addition and multiplication rule, Bay's theorem.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2: Statistical Methods

Basic Statistics: Measures of central tendency, measures of dispersion, range quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis, problems.

Statistical Methods: Correlation-karl Pearson's co-efficient of correlation problems. Regression analysis lines of regression, Rank correlation (without proof)-problems.

Curve Fitting: Curve fitting by the method of least square. Fitting of the curves of the form$y = ax + b, y = ax^2 + bx + c$ & $y = ae^{bx}$.

Self-study: Center and circle of curvature, evolutes and involutes.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-3: Complex Variable-1

Complex valued function, limit, continuity, differentiability, analytic functions. Cauchy-Riemann Equation in Cartesian, Polar form. Harmonic and orthogonal property and problems on construction of Analytic function.

Self Study : Complex Trigonometry.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-4: Z-Transforms and Difference equations

Z-Transforms: Difference Equations, Basic definitions, Damping rule, Shifting rule, Initial and Final Value theorems (without proof) and problems.

Inverse Z-transforms. Applications of Z-transforms to solve difference equation.

Self Study : Sequence and series , convergent and divergent series.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-5: Advanced Linear Algebra -2

Change of Basis, Range and Kernel of linear transformation, Rank and Nullity of a matrix, Non-singular Linear Transformation, Eigen value and Eigen vector of Linear Transformation.

Self Study : Groups, rings, fields and definition vector spaces and its properties

(RBT Levels: L1, L2 and L3) (8 Hours)

Question Paper Pattern:

• The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
• The question paper will have ten full questions carrying equal marks.
• Each full question carries 20 marks.
• There will be two full questions (with a maximum of four sub questions) from each module.
• Each full question will have sub questions covering all the topics under a module.
• The students will have to answer five full questions, selecting one full question from each module.

CIE + Assignments: 15+35=50 Marks

There will be a 3 CIE's, the average of best of 2 CIE's will be considered and there will be a 35 marks for Assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Learn to solve the random variable in both discrete and continuous and their probability distribution, Mass on various engineering problems.
CO2	Make the use ot the concept of correlation and regression lines for solving the problems and numerical techniques to solve engineering problems.
CO3	Understanding the definition of Analytic function and role of C-R equations in verifing the analyticity and construction of analytic function.
CO4	Apply the knowledge of Z-transforms in solving the difference equation arising in the time signals and digital processing. And understanding the vector and sub space and also linear dependent and independent vectors
CO5	Apply the knowledge of Linear Algebra to solve problems on Linear Transformation.

Bloom's level of the course outcomes:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

CO#	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO**	**PO9**	**PO10**	**PO1**	**PO12**	**PS 1**	**PSO2**	**PSO3**
CO1	3	2													
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	1										1			

SuggestedLearningResources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books
Text Books:

1. **B.S.Grewal**:"Higher EngineeringMathematics",Khannapublishers, 44th Ed.,2021.
2. **E. Kreyszig**: "AdvancedEngineeringMathematics", John Wiley&Sons, 10thEd., 2018.

ReferenceBooks

1. **V.Ramana:**"HigherEngineeringMathematics"McGraw-HillEducation,11th Ed.,2017
2. **SrimantaPal&SubodhC.hunia**:"EngineeringMathematics"OxfordUniversityPress,3rdEd., 2016.
3. **N.PBali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
4. **C.RayWylie,LouisC.Barrett:**"AdvancedEngineeringMathematics"McGraw–HillBookCo., Newyork, 6thEd., 2017.
5. **GuptaC.B,SingS.RandMukeshKumar:**"EngineeringMathematicforSemesterIandII"c-Graw Hill Education(India)Pvt.Ltd 2015.
6. **H.K.DassandEr.RajnishVerma:**"HigherEngineeringMathematics"S.ChandPublication,3rd Ed.,2014.
7. **JamesStewart:"**Calculus"CengagePublications,7thEd.,2019.
8. **DavidCLay:**"LinearAlgebraandits Applications",Pearson Publishers,4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

ANALOG CIRCUITS [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	22EC32	CIE Marks	50
Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03
CREDITS-04			

Course Objectives: This course will enable students to:

- Understand and analyze the AC and DC operation of BJT & FET.
- Understand the basic concepts of operational amplifier.
- Understand and analyze the AC and DC operation of Op-Amp.
- Study and design the various Op-Amp applications.

Module -1	**Teaching Hours**
BJT Biasing: Introduction, Operating point, Fixed bias configuration, Voltage divider bias configuration. (**Text1: 4.1-4.3, 4.5**) **BJT AC analysis:** Introduction, BJT transistor modeling, The re transistor model: Common emitter fixed bias configuration, Voltage divider bias configuration. The Hybrid Equivalent model, Approximate hybrid equivalent circuit: Fixed bias configuration, Voltage divider bias configuration. (**Text1: 5.1, 5.3, 5.4-5.6, 5.19, 5.20**) **Field effect transistors:** Introduction, Construction and Characteristics of JFETs, Transfer characteristics, Depletion type MOSFET, Enhancement type MOSFET. (**Text1: 6.1-6.3, 6.7, 6.8**) **JFET biasing:** Fixed bias configuration, Voltage divider bias configuration. (**Text1: 7.2, 7.4)** **JFET small signal model**: Introduction, JFET small signal model, Fixed bias configuration, Voltage divider configuration. (**Text1: 8.1-8.3, 8.5**)	**10 Hours**
Module -2	
Operational amplifier parameters and performance: Introduction, Ideal and practical operational amplifiers, Basic Op-Amp internal circuitry, Input, output & supply voltages, Offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. (**Text2: 2.1-2.6)** **Op-Amps as DC/AC amplifiers: Introduction**, Biasing Op-Amps, Direct coupled voltage follower, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers and Difference amplifier, Instrumentation amplifier, Capacitor-coupled voltage follower, Capacitor-coupled noninverting amplifier, Capacitor-coupled inverting amplifier. (**Text2: 3.1-3.4, 3.6-3.8, 4.1,4.3,4.5**)	**10 Hours**
Module -3	
Op-Amp applications: Voltage sources, Current sources and current sinks, Zero Crossing detector**,** Inverting Schmitt trigger circuit, Differentiating Circuit, Integrator Circuit, Precision rectifiers. (**Text2: 7.1, 7.2, 8.2, 8.3, 8.6, 8.7, 9.1, 9.2**)	**10 Hours**
Module -4	
More applications: Limiting circuits, Clamping circuits, Sample and hold circuits. **(Text2: 9.3, 9.4, 9.6**) Sinusoidal oscillators: Feedback concepts, Phase shift oscillator, Colpitts and Hartley Oscillators, Wein bridge oscillator. (**Text1: 14.1 Text2: 11.1-11.3)** **Active Filters:** Filter types and characteristics, First order and Second order active low-pass and High pass filters, Band-pass filters and Notch filters. (**Text2: 12.1-12.3, 12.5, 12.6**)	**10 Hours**

Module -5	
Voltage Regulator: Introduction, Series Op-Amp regulator, IC voltage regulators, 723 general purpose regulators. (**Text3: 6.1-6.4**) **555 timers**: Introduction, Description of functional diagram, Monostable operation and Astable operation. (**Text3: 8.1-8.4**) **Phase locked loop:** Introduction**,** Basic Principles, Phase detector/comparator, Voltage Controlled Oscillator (VCO). (**Text3**: **9.1-9.4**) **D-A and A-D converters**: Introduction, Weighted resistor DAC, R-2R ladder DAC, ADC using Successive approximation. (**Text3: 10.1, 10.2.1, 10.2.2, 10.3.4**)	**10 Hours**
Course Outcomes: After studying this course, students will be able to: CO1-Analyze DC and AC operation of BJT and JFET biasing circuits. CO2-Explain the characteristics of Op-Amp and design the AC and DC amplifiers using Op-Amp. CO3-Develop linear applications and Switching circuits. CO4-Develop the signal processing circuits, sinusoidal oscillators and active filters using Op-Amp. CO5- Build voltage regulator, 555 timer- based applications, phase locked loop and data Converters using Op-Amp.	
Text Books: 1. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", Pearson, 10th Edition, 2012, ISBN: 978-81-317-6459-6. 2. David A. Bell, "Operational Amplifiers and Linear ICs", Oxford University Press, 3rd Edition, 2011. 3. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition, 2010, ISBN 978-81-224-3098-1.	
Reference Books: 1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008. 2. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw-Hill Education, 2nd Edition, 2007. 3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Edition, 2015.	

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	N	Y	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	Y	N	N	N
CO4	Y	Y	Y	N	N	N
CO5	Y	Y	Y	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	3	-	-	-	-	1	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO4	3	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	1	-	-	-	-	-	3	-	-

DIGITAL SYSTEM DESIGN

[As per NEP, Outcome Based Education (OBE), and Choice Based Credit System (CBCS) Scheme

SEMESTER-III

Subject Code	22EC33	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives:

This course will enable students to:

- Illustrate Boolean laws & systematic technique for minimization of Boolean expressions.
- Demonstrate the methods for simplifying Boolean expressions.
- Introduce the basic concepts of Combinational logic & Sequential logic.
- Present real-world examples for making the learner attuned to logic concepts.
- Highlight the formal procedures for the analysis and design of combinational logic & sequential logic.

Module1	**Teaching Hours**
Principles of Combination logic: Introduction, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations, General approach to combinational logic design. **(Text 1- Chapter 3)**	**8 Hours**
Module2	
Applications of Combination logic: Decoders, Encoders, Digital multiplexers, Design of Boolean function using Multiplexers, Adders and Subtractors, Parallel Adder, Comparators.**(Text 1- Chapter 4)**	**8 Hours**
Module3	
Principles of Sequential Circuits: Introduction, Basic Bi-stable elements, Latches, The Master-S-lave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic equations. **(Text 2- Chapter 6)**	**8 Hours**
Module4	
Applications of Sequential Circuits: Registers, Binary ripple counters, Synchronous binary counters, Counters based on shift registers, Design of synchronous counters, Design of asynchronous mod-n counter using clocked T, JK, D and SR flip-flops. **(Text 2- Chapter 6)**	**8 Hours**
Module5	
Applications of Digital circuits: Design of Sequence Detector, Guidelines for construction of State graphs, Design Example- Code converter, Design of Iterative Circuits, Design of Sequential Circuits using ROMs and PALs, Serial Adder with Accumulator. **(Text 3 – 14.1,14.3, 16.2-16.4, 18.1)**	**8 Hours**
Course Outcomes: After studying the course students will be able to: CO1- Apply the Karnaugh map method to derive minimal forms of Boolean expressions in digital systems. CO2- Design and implement various combinational circuits. CO3-Analyze the various latches and flip-flops using their characteristic equations. CO4- Design and develop sequential counters and shift registers using flip-flops. CO5- Design Mealy and Moore models along with state diagrams to analyze clocked sequential circuit.	

Text Books: 1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001.ISBN981-240-062-1. 2. Donald D.Givone,―Digital Principles and Design‖, McGraw Hill, 2002. ISBN 978-0-07-052906-9. 3. Charles H Roth Jr., Larry L.Kinney – Fundamentals of Logic Design, Cengage Learning, 7th Edition.	
ReferenceBooks: 1. D.P.Kothari and J.S Dhillon, Digital Circuits and Design‖, Pearson, 2016, ISBN : 9789332543539 2. Morris Mano, ―Digital Design, Prentice Hall of India, Third Edition.	

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	Y	Y	N	N
CO5	Y	Y	Y	Y	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

NETWORK ANALYSIS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22EC34	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the concepts of transformation techniques, mesh and Nodal analysis of DC circuits.
- Apply the knowledge of basic circuit law to simplify the networks using network theorems and explain design concept of attenuators and filters
- Explain importance of series and parallel resonance circuits.
- Impart the basic knowledge of network analysis using Laplace transforms.
- Understand the basic knowledge of two port networks.

Module-1	**Teaching Hours**
Network Analysis Techniques: Sources and its types, Source Transformation and Source Shifting, Network Reduction using Star Delta Transformation, Mesh Analysis, Node Analysis, Concept of Supermesh and Supernode. (only DC circuits with independent and dependent sources)	**08Hours**
Module-2	
Network theorems Superposition Theorem, Reciprocity Theorem, Milliam's Theorem, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem.	**08Hours**
Module-3	
Attenuators and Conventional Filters: Nepers, Decibles, lattice attenuator, T-type attenuator, π-type attenuator, L-type attenuator, ladder type attenuator, insertion loss. Filter fundamentals	**08Hours**
Module-4	
Resonant Circuit: Introduction to Series and Parallel Resonance, properties, derivation and numericals on Resonant Frequency, Bandwidth and Quality Factor. **Laplace Transform:** Solution of Networks, Step, Ramp and Impulse Responses ,Waveform Synthesis	**08 Hours**
Module-5	
Two Port Network: Definition of Z, Y, h and Transmission Parameters, Modeling with these Parameters, Relationship between Parameters sets.	**08Hours**

Course Outcomes: After studying this course, students will be able to:

CO1- Analyze the basic concepts, laws, and methods for DC network analysis. Simplify the network using transformation and shifting techniques.

CO2- Apply network theorems to solve complex electrical circuits.

CO3- Develop simple passive filters and attenuators for given specifications.

CO4- Design series and parallel resonance circuits, and synthesize typical waveforms using the Laplace transform.

CO5- Determine the performance parameters of a two-port network.

Text Books:

1. M.E.VanValkenberg(2000),—Network analysis, Prentice Hall of India, 3rd edition, 2000.
2. Roy Choudhury, — Networks and systems, 2nd edition, New Age International Publications, 2006.

Reference Books:

1. Hayt, Kemmerly and Durbin—Engineering Circuit Analysis ǁ,TMH 7th Edition, 2010
2. J.David Irwin, R. Mark N elms,—Basic Engineering Circuit Analysisǁ, JohnWiley, 8thed, 2006.
3. Charles K Alexander and Mathew NO Sadiku,— Fundamentals of Electric Circuits, Tata McGraw-Hill,3rdEd, 2009

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	Y	N	N
CO3	Y	Y	Y	N	N	N
CO4	Y	Y	N	Y	N	N
CO5	Y	Y	N	N	Y	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

SENSORS AND ACTUATORS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22EC35	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- Understand the fundamental knowledge about sensors and measurement system.
- Understand the principle, design and working of transducers for the measurement electrical and non electrical quantities.
- Understand the working of various actuators suitable in industrial process control systems.

Module -1	**Teaching Hours**
Measurements and Measurement Systems: Measurements, significance of measurements, Methods of Measurements, Instruments and measurement systems, Mechanical, electrical and electronic instruments, Classification of Instruments Elements of generalized measurement system, Input-output configurations of measuring instruments and measurement systems, Methods of correction for interfering and modifying inputs.(Text1: 1.1-1.6, 1.13, 1.14, 1.15)	**8 Hours**
Module -2	
Transducers: Introduction, Classification of transducers-Primary and Secondary transducers, Passive and Active transducers, Analog and Digital transducers, Resistive transducers: Potentiometers introduction, Construction of potentiometers, Advantages and disadvantages of resistance potentiometers, Variable inductance transducers, Linear variable differential transformer(LVDT), Capacitive transducers, Digital encoding transducers: Classification of encoders, Construction of encoders. (Text1: 25.6, 25.8, 25.12, 25.15, 25.23, 25.24, 25.28, 25.34-25.36)	**8 Hours**
Module -3	
Resistance thermometers, Thermistors: Construction of thermistors, Resistance-Temperature characteristics of thermistors, Application of thermistor in measurement of temperature, Salient features of thermistors. Thermocouples: Construction of thermocouples, Measurement of thermocouple output, Compensating circuit, Reference junction compensation, Lead compensation, Advantages and disadvantages of thermocouples, Integrated circuit temperature transducers. (Text1: 25.19, 25.20, 25.21, 25.22)	**8 Hours**
Module -4	
Measurement of humidity, sound using microphones and pH value. (Text1: 29.45,29.46, 29.47) **Actuators and process control system:** Introduction, block diagram and description of process control system with an example. Introduction, block diagram of final control operation, Signal conversions analog, digital, pneumatic signal. Actuators, Control elements. (Text2: Chapter1 (1,2,3), Chapter6 (1,2,3))	**8 Hours**
Module -5	
Electrical actuating systems: Solid-state switches, Solenoids. **Electric Motors- Principle of operation and its application:** D.C motors, AC motors, Synchronous Motor, Stepper motors, Pneumatic Actuators: Principle and working of pneumatic actuators, Hydraulic Actuators: Principle and working of Hydraulic actuators. (Text2: Chapter6 (5.1,5.2,5.3)) (Numerical problems on the topic).	**8 Hours**

Course outcomes: After studying this course, students will be able to:

CO1-Discuss the fundamental concepts related to sensors and measurements and apply them for characterizing measurement systems.

CO2- Explain the transducers and analyze measurement systems using transducers.

CO3- Apply the suitable transducers for measurement of temperature, humidity, sound and pH value.

CO4- Discuss the fundamental concepts of process control system and analyze the process control systems.

CO5- Analyze actuators operation in control systems.

Reference Books:

1. Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 19th Edition, Dhanpat Rai & Co. Pvt. Ltd.
2. Process Control Instrumentation Technology, C D Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	Y	N	N
CO3	Y	Y	Y	N	N	N
CO4	Y	Y	Y	Y	N	N
CO5	Y	Y	N	Y	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING(1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

ANALOG CIRCUITS LAB

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22ECL36	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course will enable students to:

- Characterize the JFET and MOSFET.
- Design and evaluate the BJT amplifier.
- Design and realize the various Op-Amp applications.
- Design and realize Monostable and Astable multivibrator using 555 Timer.
- Design and realize the fixed voltage power supply using IC regulator.

List of Experiments:

1. Verify JFET/MOSFET characteristics.
2. Design and test the BJT amplifier circuit and obtain the frequency response characteristics.
3. Design and testing of Inverting and Non inverting amplifier using Op-Amp.
4. Design an instrumentation amplifier of a differential mode gain of 'A' using three amplifiers.
5. Design and testing of RC phase shift oscillator using Op-Amp.
6. Design and testing of Wein bridge oscillator using Op-Amp.
7. Design and verify the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
8. Design and realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
9. Design and verify a Precision full wave rectifier.
10. Design of Monostable and Astable multivibrator using 555 Timer.
11. Design and realization of R – 2R ladder DAC.
12. Design of Fixed voltage power supply (voltage regulator) using IC regulator 78 series.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING

COURSE OUTCOME	Remember L1	Understand L2	Apply L3	Analyze L4	Evaluate L5	Create L6
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	N	N	Y
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

DIGITAL SYSTEM DESIGN LABORATORY

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22ECL37	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course enables students to get practical experience in design, realization and verification of

- Demorgan's Theorem, SOP, POS forms
- Full/Parallel Adders, Subtractors and Magnitude Comparator
- Multiplexer, Demultiplexers, encoder and Decoders applications
- Flip-Flops, Shift registers and Counters

Note: Use discrete components to test and verify the logic gates. The IC numbers given are suggestive. Any equivalent IC can be used.

- For experiment No. 11 any open source or licensed simulation tool may be used.

List of Experiments:

1. Verify
    a. Demorgan's Theorem for 2 variables
    b. The sum-of product and product-of-sum expressions using universal gates
2. Design and implement
    a. Half Adder
    b. Full Adder
    c. Full subtractor
3. Design and implement 4-bit Parallel Adder/Subtractor using IC7483
4. Design and implement 3-bit Binary to Gray code converter
5. Realize a 4-variable function using IC 74151 (8:1 MUX)
6. Realize Adder/Subtractor using IC 74139
7. Design and Implementation of 4-bit Magnitude Comparator using IC7485
8. Realize the following shift registers using IC7474/IC7495
    a. SISO (b) SIPO (c) PISO (d) PIPO
9. Realize Ring and Johnson counter
10. Realize Mod-N Asynchronous/Synchronous counter
11. Simulate Full-Adder and Mod-8 Synchronous UP/DOWN Counter using simulation tool

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	N	N	Y
CO3	N	N	N	N	N	Y
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

NETWORK ANALYSIS LABORATORY

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22ECL38	CIE Marks	50
Number of practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Realize the basic laws, KVL and KCL.
- Realize the network theorems.
- Calculation of frequency response, Quality, bandwidth for both series & parallel resonant circuits.
- Analysis and understand locus diagram.
- Calculate the networks parameters for different two port networks.

NOTE: The experiments are to be carried out using discrete components, out of which three experiments are to be carried out through simulation

List of Experiments:

1. Measurements of DC circuits.
2. Study of Mesh Analysis & Node Analysis.
3. Realization & verification of Superposition theorem
4. Realization & verification of Reciprocity theorem
5. Realization & verification of Thevenin's & Norton's theorem
6. Realization & verification of Maximum power transfer theorem
7. Realization & verification of Milliman's theorem
8. Analysis of series resonance.
9. Analysis of parallel resonance.
10. Locus Diagrams of RL and RC Series Circuits
11. Study of Z &Y parameters of two port network parameters.
12. Transmission and hybrid parameters.

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	N	N	Y
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

PROJECT-III [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	22PRJ39	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: This course will enable students to:

- Get exposure about the electronics hardware and various software tools.
- Design the working model of the open ended problem.
- Understand concepts of Packaging.
- Understand the latest technology trends in the PCB design.
- 5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN A TEAM.

Course outcomes: After studying this course, students will be able to:

CO1-Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2-Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3-Design and implement the system to solve the real time problem of the society.

CO4-Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO-5-Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	Y	N	N
CO3	Y	Y	N	N	N	Y
CO4	Y	Y	N	N	Y	N
CO5	Y	Y	Y	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**3**	3	**-**	**3**	**-**	**3**	**-**
CO2	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**-**
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**3**	**3**	**2**	**3**	**-**	**3**	**-**
CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**
CO5	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**

SOFT SKILLS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-V

Course Code	22HSM310	CIE Marks	50
Number of Lecture Hours/Week	01	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03hrs

CREDITS– 03

Course Learning Objectives:

- To enable the students to obtain the basic knowledge about Communication Skills: Meaning, definition, importance, purpose, process, types, barriers and Essential of communication.
- Develop reading and understanding ability
- Learn effective writing.
- Learn how to write different types of letter.
- Case method of learning.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
INTRODUCTION TO COMMUNICATION: Meaning, Definition, Importance & Purpose of Communication, Process of Communication, Types of Communication, Communication network in an organization, 7c's of communication, Barriers to Communication and Essential of good Communication.	**06 Hours**	**L1,L2,L3**
Module -2		
READING AND UNDERSTANDING – Reading Comprehension – Reading rate and reading comprehension, Paraphrasing, Interpretations of graphical information, Book reading and summarizing it.	**06 Hours**	**L1,L2,L3**
Module -3		
EFFECTIVE WRITING: Purpose of Writing, Clarity in Writing, Principle of Effective Writing. Better writing using personal Experiences – Describing a person, situation, memorable events etc….	**05 Hours**	**L1,L2,L3**
Module –4		
DRAFTING OF LETTERS: Writing different types of letters – writing for employment, joining letter, complaints & follows up , Enquiries, representation etc. Official Communication – e-mail & Social Media.	**06 Hours**	**L1,L2,L3**
Module -5		
CASE METHOD OF LEARNING: Understand Case method of learning, different type of cases, overcoming the difficulties of the case method, analyzing the case. Do's & Don'ts for case preparation.	**05 Hours**	**L1,L2,L3**

Course Outcomes: At the end of this course, students should be able to

CO1- Describe the process, types and importance of communication in various contexts.

CO2- Develop the ability to read books or lengthy texts with critical comprehension, effectively identifying and analyzing key themes, arguments, and main ideas.

CO3- Develop writing skills by effectively describing people, situations, and memorable events and demonstrate responsibility, self-management, self-confidence and ethical behavior.

CO4- Develop the ability to draft various professional letters such as employment application, Joining letters, complaints, follow ups and representations.

CO5- Foster teamwork abilities through collaborative case study discussion and problem solving Exercises.

Text Book:

1. Scotofer, contemporary business communication, Biztant ra
2. Chaturvedi P D & Mukesh chaturvedi - Business communication:Concepts, cases & applications- 2/e, pearson education.
3. Essential of Business communication – Rajendra Pal and J.S Korlhall – Sultan Chand & Sons, New Delhi

Reference Books:

1. Business correspondence & report writing – R.C.Sharma, Krishna Mohan – Tata Megraww Hill Publising Company Ltd, New Delhi.
2. Business Communcation – K.K. Sinha – Galgotio Publishing Company, New Delhi.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	2	-	-	2
CO3	-	-	-	-	-	3	-	3	-	3	-	2	-	-	3
CO4	-	-	-	-	-	3	-	3	-	3	-	2	-	-	2
CO5	-	-	-	-	-	3	-	3	3	3	-	2	-	-	3

ANALOG ELECTRONICS LAB USING PSPICE/MULTISIM/LTSPICE

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22AEC311A	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course will enable students to:

- To provide practical exposure on designing, setting up, executing and debugging various electronic circuits.
- Use open source simulation software to analyze the circuits.

Experiments using Pspice/Multisim/LTspice software

List of Experiments:

1. Realize JFET/MOSFET characteristics.
2. Realize BJT amplifier circuit and obtain the frequency response characteristics.
3. Design and realize Inverting and Non inverting amplifier using Op-Amp.
4. Realize RC phase shift oscillator using Op-Amp.
5. Realize Wein bridge oscillator using Op-Amp.
6. Realize the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
7. Realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
8. Design and verify a Precision full wave rectifier.
9. Design and realize Monostable and Astable multivibrator using 555 Timer.
10. Realize R – 2R ladder DAC.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3- Analyse experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4- Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5- Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)

COURSE OUTCOME	Remember L1	Understand L2	Apply L3	Analyze L4	Evaluate L5	Create L6
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	N	N	Y
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	Y	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

DIGITAL SYSTEM DESIGN LAB USING PSPICE/MULTISIM/LTSPICE

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22AEC311B	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course will enable students to:

- Provide practical exposure to the students on designing, setting up, executing and debugging various electronic circuits using simulation software.
- Give the knowledge and practical exposure on simple applications of digital electronic circuits.
- Analyze and design sequential and combinational logic circuits.
- Use open source software like Pspice/Multisim/LTspice

Experiments using Pspice/Multisim/LTspice software

List of Experiments:

1. Verify
   (a) DeMorgan's Theorem for two variables.
   (b) The sum-of product and product-of-sum expressions using universal gates.
2. Design and implement
   (a) Half Adder.
   (b) Full Adder.
   (c) Full Subtractor.
3. Design and implement 4-bit Parallel Adder / Subtractor using IC7483.
4. Design and implement 3-bit Binary to Gray code converter.
5. Realize a 4-variable function using IC 74151 (8:1 MUX)
6. Realize Adder / Subtractor using IC 74139
7. Design and Implementation of 4-bit Magnitude Comparator using IC7485.
8. Realize the following shift registers using IC7474/IC7495
   (a) SISO (b) SIPO (c) PISO (d) PIPO
9. Realize Ring and Johnson counter.
10. Realize Mod-N Asynchronous / Synchronous counter.

Course Outcomes: After studying this course, the students will be able to:

CO1- Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2- Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5: Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	N	N	Y
CO3	N	N	N	N	N	Y
CO4	Y	Y	Y	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

ADDITIONAL MATHEMATICS – I

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	22MATDIP31	CIE Marks	00
Number of Lecture Hour/Week	4L	SEE Marks	100
Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives: This course will enable students to:

- Acquire basic concepts of complex trigonometry, vector algebra, differential & integral calculus and vector differentiation.
- Evaluation of double and triple integrals.
- Know the basic concepts of partial differential equations.
- To develop the knowledge of matrices and linear algebra in compressive manner.
- To understand the essential concept of linear algebra.

Module -1	**Teaching Hours**
Complex Trigonometry-1: Complex Numbers: Definition and Properties. Modulus and Amplitude of complex number, Argand's diagram , De-Moivre's theorem (without proof) Vector Analysis: Scalar and Vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products) Scalar and vector triple products- simple problems, Vector Differentiation : Gradient, Divergence and Curl.	08 Hours
Module -2	
Differential Calculus: Review of successive differentiation. Formulae of N^{th} derivatives of standard functions- Leibnitz's theorem (without proof). Polar Curves: Expression for Angle between radius vector and tangent, length of perpendicular from pole to the tangent, angle between two polar curves, Pedal Equation of polar curves and problems. Taylor' and Maclaurin'sseires expansions.	08 Hours
Module -3	
Partial Differentiation : Definitions of Partial Differentiation, Direct and Indirect partial derivatives, Symmetric functions, Homogeneous function and Euler's theorem on homogeneous function. Total Derivative of composite and implicit function. Jacobian.	08 Hours
Module -4	
Integral Calculus: Reduction Formulae of $\int_0^{\pi/2} Sin^n x dx$, $\int_0^{\pi/2} Cos^n x dx$, and Statement of Reduction formulae $\int_0^{\pi/2} Sin^m x Cos^n x dx$ and Problems. Double and Triple integral- simple problems.	08 Hours
Module -5	
Linear Algebra: Basic concepts of matrices- Rank of matrix by elementary row transformations- Echelon form. Consistency of system of Linear equations. Solution of system linear equations by Gauss Elimination method, Linear Transformation, Cayley-Hamilton theorem to compute inverse of matrix. Eigen values and Eigen vector, Largest Eigen value and corresponding Eigen vector by Reyleigh's Power method.	08 Hours

Course Outcomes: After studying this course, students will be able to:

CO1-Apply derivatives and partial derivatives to calculate rates of change of multivariate functions.

CO2-Apply techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region.

CO3-Analyze position, velocity and acceleration in two or three dimensions using the calculus of vector valued functions.

CO4-Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

CO5-Solve systems of linear equations in the different areas of linear algebra.

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.

2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO5	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Engineering Mathematics – IV For ECE & EEE Branch			
Course Code:	**22MATE41**	**CIE Marks**	**50**
Contact Hours/Week	**03**	**SEE Marks**	**50**
Total Hours	**40**	**Exam Hours**	**03**
Semester	**IV**	**Credits**	**03**

Course objectives: The goal of the course Mathematics for Electronics & Communication EngineeringStream-IV(22MATE41)is to

- Able to analyze and apply the concept of Fourier Series.
- Understand and apply the concept of Fourier Transforms. Understand Joint probability distribution and stochastic processes arising in science and Electrical and Electronics engineering.
- Understand and analyze the sample data using different distribution.
- Develop the knowledge of sampling theory in day to day life and trace different types of curves..
- Develop the Knowledge of Complex Integration.

MODULE-1: Fourier Series

Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodicfuncti ons with period 2π and with arbitrary period 2c. Fourier series of even and odd fu nctions Half range Fourier Series, practical harmonic analysis(5 Assignment Problem).
Self-Study: Sequence and series of a function, convergent series.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2 : Fourier Transform

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier-transform (5 Assignment Problem).
Self Study:
Applications :
(RBT Levels: L1, L2 and L3) (8 Hours**)**

MODULE-3: Joint probability distribution and Stochastic processes

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.
Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability- simple problems.
Applications of Joint probability distribution:
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: Sampling theory and curve tracing

Sampling theory : Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, Type I and Type II errors, Level of significance, confidence limits for means, one tailed and two tailed tests, student's t-distribution, Chi - square distribution as a test of goodness of fit.
Tracing of curves: Cartesian form - Strophoid, Leminscate, Parametric form - Cycloid, Astroid, Polar form - Cardioid, Leminscate.
Self Study : Types of samplings, Cartesian equations and their geometrical

representation
Applications of Sampling theory and curve tracing:

(RBT Levels: L1, L2 and L3)

MODULE- 5: Complex variable-2

Complex line Integrals: Cauchy's Integration theorem, Cauchy integral formula, Laurent'sSeries, types of singularities. Residue, Poles, Cauchy's Residue theorem (without proof) and Problems.
Transformations: Bilinear transformations and problems.
Self Study : Initial value and boundary value problems

(RBT Levels: L1, L2 and L3) **(8 Hours)**

Question Paper Pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reducedto 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

CIE + Assignments: 15+35=50 Marks
There will be a 3 CIE's, the average of best of 2 CIE's will be considered and there willbe a 35 marks for Assignments

SuggestedLearningResources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)TextBooks

1. **B.S.Grewal**:"Higher EngineeringMathematics",Khannapublishers, 44th Ed.,2021.
2. **E. Kreyszig**: "AdvancedEngineeringMathematics", John Wiley&Sons, 10thEd., 2018.

ReferenceBooks

1. **V.Ramana:**"HigherEngineeringMathematics"McGraw-HillEducation,11th Ed.,2017
2. **SrimantaPal&SubodhC.Bhunia**:"EngineeringMathematics"OxfordUniversityPress,3rdE d., 2016.
3. **N.PBali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi

Publications,10th Ed.,2022.
4. **C.RayWylie,LouisC.Barrett:**"AdvancedEngineeringMathematics"McGraw–HillBookCo., Newyork, 6thEd., 2017.
5. **GuptaC.B,SingS.RandMukeshKumar:**"EngineeringMathematicforSemesterIandII",Mc-Graw Hill Education(India)Pvt.Ltd 2015.
6. **H.K.DassandEr.RajnishVerma:**"HigherEngineeringMathematics"S.ChandPublication,3rdEd.,2014.
7. **JamesStewart:"**Calculus"CengagePublications,7thEd.,2019.
8. **DavidCLay:**"LinearAlgebraandits Applications",Pearson Publishers,4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Understanding the Periodic function and Fourier series expansion of different functions and its application to analyze circuits.
CO2	Apply the knowledge of Fourier transform
CO3	Learn to solve the problems on Joint probability distribution for two discrete random variables. Knowing the concept of stochastic processes, probability vector, Probability matrix and studying the examples on Markov's chains in discrete time.
CO4	Understanding the Sampling Distribution to find the standard error for testing of hypothesis and learn to trace the Curve.
CO5	Learn Cauchys Integration theorem Residue to solve problems in higher engineering

Bloom's level of the course outcomes:

CO#	**Bloom's Level**					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

CO#	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			
CO5	3	2										1			

ANALOG AND DIGITAL COMMUNICATION

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22EC42	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals. ·
- Analyze pulse modulation and sampling techniques.

Modules	Teaching Hours
Module -1	
Amplitude Modulation: Amplitude Modulation, Virtues, Limitations, and Modifications of Amplitude Modulation, Double Sideband-Suppressed Carrier Modulation, Costas Receiver, Quadrature-Carrier Multiplexing, Single-Sideband Modulation, Vestigial Sideband Modulation. (Text 1: 3.1 to 3.7).	**8 Hours**
Module -2	
Angle Modulation: Basic Definitions, Narrowband frequency modulation, generation of FM waves, Demodulation of FM signal using frequency discriminator (Text 1: 4.1, 4.4, 4.7, 4.8), Detection of Frequency modulation(Text 1: 9.7). **Pulse Modulation: Transition from analog to digital communications:** Sampling process, Pulse Amplitude Modulation, pulse position modulation, completing the Transition from analog to digital, (Text 1: 5.1, 5.2, 5.4).	**8 Hours**
Module -3	
Pulse Modulation: Transition from analog to digital communications: Quantization process, Pulse code modulation (PCM), Delta modulation, Differential pulse code modulation, line codes (Text 1: 5.5 to 5.9). **Baseband Data Transmission:** Baseband transmission of digital data, The intersymbol interference problem, The Nyquist channel, The eye pattern (Text 1: 6.1 to 6.4 and 6.5).	**8 Hours**
Module -4	
Digital Band Pass Modulation Techniques: Binary amplitude shift keying, Phase shift Keying, Frequency shift keying, Summary of three binary signaling schemes, Non coherent digital modulation schemes, M-ary Digital modulation scheme, Mapping of digitally modulated waveform onto constellations of signal point(Text 1: 7.2 to 7.8)	**8 Hours**
Module-5	
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum(Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4).	**8 Hours**

Course Outcomes: At the end of this course students will demonstrate the ability to

CO1- Comprehend and analyze the basic principles of Amplitude Modulation (AM).

CO2- Apply the knowledge of sampling and analyze Angle modulation techniques used in communication systems.
CO3- Examine inter-symbol interference (ISI) and understand the role of the Nyquist channel in baseband transmission.
CO4- Generation and detection of signals using digital band pass modulation techniques
CO5- Comprehend the different types of spread spectrum communication systems.

Text Books

1. Simon Haykin, Michael Moher " Introduction to Analog And Digital Communications " 2nd Edition 2013.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
4. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Reference Books:

1. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
2. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
3. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	Y	N	N
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	Y
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

MICROCONTROLLER

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]
SEMESTER-IV

Subject Code	22EC43	CIE Marks	50
Number of Lecture Hours/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course objectives: This course will enable students to:

- Understand the basics of microcontroller, Embedded systems and architecture of 8051 microcontroller.
- Explain and analyze the instruction sets of 8051 microcontrollers and also to write the Assembly Level Programs using 8051 Instruction set.
- Understand and write peripheral programming for Timers, Serial Port and Interrupt system of 8051.
- Analyze the Application and Interfacing of 8051Microcontroller to I/O devices.

Module -1	**Teaching Hours**
8051 Microcontroller: Introduction to 8051, Embedded systems, Microprocessor vs. Microcontrollers., Desirable Features of embedded systems. 8051 Architecture- Oscillator and Clock, Role of PC and DPTR, Flags and PSW, CPU registers, Internal RAM and RAM organization, Internal Memory, Special Function Registers, I/O pins, ports and circuits, External memory, Counter and Timers, Serial Transmission, Interrupts.	**08 Hours**
Module -2	
8051 Instruction Set: Addressing Modes, Data Transfer Instructions, Logical Instructions, Arithmetic Instructions, Jump Loop & Call Instruction, 8051 Stack, Stack and Subroutine instructions.	**08 Hours**
Module -3	
Assembly Language Programming: Assembly language program involving Jump, Loop, Call, Arithmetical and Logical Instructions, I/O Port Programming, Data conversion programs, Data types and time delays.	**08 Hours**
Module -4	
Peripheral Programming: 8051 timer programming, serial port and its programming, interrupt programming**.**	**08 Hours**
Module -5	
Interfacing and its Applications: LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory **,** Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.	**08 Hours**

Course outcomes: At the end of the course, students will be able to:

CO1- Demonstrate the basics of microcontrollers and embedded systems, including the architecture of the 8051 microcontrollers.
CO2-Explore the instruction set of 8051 microcontrollers.
CO3-Develop the programs using the 8051-microcontroller instruction set.
CO4- Develop programs for timers, counters, serial communication and interrupts in 8051 microcontrollers.
CO5- Develop programs for various interfacing applications in the 8051 microcontrollers.

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson /Cengage Learning.

Reference Book:

1. " The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	N	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	Y	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	Y	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	2	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	2	-	-	-	-	-	3	-	-

SIGNALS AND SYSTEMS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22EC44	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- Understand the classification of signals into different categories based on their properties. Explain basic operations on signals and properties of systems.
- Use convolution in both continuous and discrete domains for the analysis of systems given the impulse response of a system.
- Evaluate response of a given linear time invariant system and Fourier representation of periodic signals.
- Apply continuous time Fourier transform representation and discrete time Fourier transform representation to study signals and linear time invariant systems.
- Use Z-transform and properties of Z transform for the analysis of discrete time systems.

Modules	Teaching Hours
Module -1	
Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Classification of signals. **Basic Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal. **Elementary signals/Functions:** Exponential, sinusoidal, step, impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals.	**08 Hours**
Module -2	
System Classification and properties: Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, stable-unstable, invertible. **Time domain representation of LTI System:** Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.	**08 Hours**
Module -3	
Differential & Difference Equation representation of LTI systems: Solution for Differential & Difference equations. Fourier Representation of Periodic Signals: Orthogonality of complex sinusoids, CTFS properties (No derivation) and basic problems.	**08 Hours**
Module -4	
Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships.	**08 Hours**
Module-5	
The Z-Transforms : Z transforms, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform.	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO1- Analyze the fundamental concepts of signals, including their classifications and perform basic operations on signals.
CO2- Analyze the fundamental concepts of systems and apply the convolution integral and sum to compute the responses of continuous and discrete LTI systems.
CO3- Analyze LTI systems through differential and difference equations, and explore the Fourier representation of periodic signals.
CO4- Examine the spectral characteristics of continuous and discrete-time signals using Fourier analysis.
CO5- Analyze the region of convergence (ROC) and apply Z-transform properties to simplify discrete-time signals.

Text Book:

Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.

Reference Book:

1. Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. H. P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006.
4. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005.
5. Ganesh Rao and Satish Tunga, "Signals and Systems", Pearson/Sanguine

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	N	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	Y	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

INFORMATION THEORY AND CODING

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22EC45	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to :

- Provide an insight into the concept of information in the context of communication theory and its significance in the design of communication receivers.
- Study various source encoding algorithms.
- Model the communication channels.
- Study various error control coding algorithms.

MODULE -1	**Teaching Hours**
Information Theory: Introduction, Measure of information: Information content of a message, Average information content of symbols in long independent sequences, Average information content of symbols in long dependent sequences, Markoff statistical model for information sources, Entropy and information rate of Markoff sources. (Section 4.1, 4.2 of Text 1)	**08 Hours**
MODULE -2	
Source Coding: Encoding of the source output: Shannon's Encoding Algorithm. (Section 4.3 of Text 1) **Shannon Fano Encoding Algorithm, Arithmetic Coding. (Section 3.6, 3.8 of Text 3)** Source coding theorem: Prefix Codes, Kraft-McMillan inequality property, Huffman codes. (Section 2.2,2.3 of Text 2)	**08 Hours**
MODULE -3	
Information Channels: Communication Channels, Discrete Communication channels. (Section 4.4, 4.5: 4.5.1 of Text 1) Mutual Information, Channel capacity of binary symmetric channel. (Section 2.5, 2.6 of Text 2)	**08 Hours**
MODULE -4	
Error Control Coding: Introduction, Linear block codes: Matrix description of linear block codes. Binary cyclic codes: Algebraic structure of cyclic codes, Encoding using an (n-k) bit shift register, Syndrome calculation, Error detection and error correction. (Section 9.1, 9.2:9.2.1, 9.3:9.3.1, 9.3.2, 9.3.3 of Text 1)	**08 Hours**
MODULE-5	
Some Important Cyclic Codes: BHC Codes (Section 8.4 – Article 5 of Text 2). **Convolution Codes**: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree. (Section 8.5 of Text 2)	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO1-Explain the fundamental concepts of information theory and apply them to statistical Markov modeling.

CO2-Apply the various types of source coding algorithms and analyze their performance.

CO3- Analyze the discrete communication channels using probability channel matrix.

CO4- Develop the linear block codes and cyclic codes for error detection and correction.

CO5- Develop the convolution codes for channel coding.

Text Books:

1. Digital and Analog Communication Systems, K. Sam Shanmugam, John Wiley India Pvt. Ltd, 1996.
2. Digital Communications, Simon Haykin, John Wiley India Pvt. Ltd, 2008.
3. **Information Theory and Coding, Muralidhar Kulkarni, K.S. Shivaprakasha, Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.**

Reference Books:

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007
2. Digital Communications- Fundamentals and Applications, Bernard Sklar, Second Edition, Pearson Education, 2016.
3. Information Theory and Coding, K.N. Haribhat, D. Ganesh Rao, Cengage Learning, 2017.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	Y	N	N
CO3	Y	Y	Y	Y	N	N
CO4	Y	Y	Y	N	N	N
CO5	Y	Y	Y	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

ANALOG AND DIGITAL COMMUNICATION LAB

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22ECL46	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives : Students will be taught to:

- Design, Demonstrate and Analyze filters using op-amp.
- Design, Demonstrate and Analyze analog systems for AM, FM, PPM, PAM, PWM
  - operations.
- Design and demonstrate the digital modulation techniques.
- study phase lock loop and its capture range, lock range and free running VCO.

Laboratory Experiments

1. Design active second order Butterworth low pass and high pass filters.
2. Amplitude modulation using transistor/FET (Generation and detection).
3. Frequency modulation using IC 8038/2206 and demodulation.
4. Frequency synthesis using PLL
5. Pulse amplitude modulation and detection.
6. Pulse Width modulation and detection.
7. Pulse Position Modulation and detection.
8. Time Division Multiplexing and De-multiplexing of two band limited signals.
9. ASK generation and detection.
10. FSK generation and detection.
11. PSK generation and detection.
12. PCM generation and detection.

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	N	Y	N	N
CO3	Y	Y	N	N	N	Y
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

MICROCONTROLLER LAB

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22ECL47	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to :

- Write 8051 application specific programs in Assembly Language and C for 8051.
- Interface various hardware modules to 8051 Microcontroller board.
- Use open source software tools like Keil and Flash magic.
- Develop applications based on Microcontroller 8051.

List of Experiments:

Software program using 8051 Microcontroller

Simple Assembly Language;

1. Program using 8051 in Block, Move, Exchange.
2. Program on Arithmetic Instructions - Addition/Subtraction, Multiplication and Division, Square, Cube
3. Program in sorting, finding largest and smallest element in an array.
4. Counters ---> For Hex and BCD up/ down count.
5. Boolean and Logical Instructions. (Bit Manipulation).
6. Subroutines using CALL and RETURN Instructions.
7. Code Conversions ---> ASCII to Decimal, Decimal to ASCII, BCD to ASCII

Hardware Programming (using 8051 With C Program)

1. Stepper Motor Interface to 8051 Microcontroller.
2. Seven Segment Displays to 8051 Microcontroller.
3. Hex Keyboard Interface to 8051.
4. DAC Interface for to generate Sine wave, Square wave, Triangular wave, Ramp wave through 8051Microcontroller.
5. ADC Interfacing to 8051 Microcontroller
6. LCD Interfacing to 8051 Microcontroller

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

SIGNALS AND SYSTEMS LAB

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22ECL48	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

- Simulate basic signals impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
- Find the even and odd component of the signal and computation of energy and power of the
  - signal.
- Find solution to the difference equations and computation of convolution.
- Compute the DFT for a discrete signal.
- Evaluate the sampling theorem.

Note: The experiments are to be carried using Matlab/ Scilab/ Octave or equivalent.

List of Experiments:

1. Generate and plot elementary signals like impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
2. To calculate signal energy and signal power.
3. Finding even and odd of the signal.
4. Perform operations on independent variable of a signal.
5. Perform operations on dependent variable of a signal.
6. To compute the linear convolution of the given input sequence & the impulse response of the system.
7. Find the Fourier transform, plot magnitude and phase.
8. Find the inverse Fourier transform, plot magnitude and phase.
9. Solve any given difference equation of an LTI System.
10. Demonstration of sampling theorem.
11. Finding frequency response of LTI system.

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING

COURSE OUTCOME	Remember L1	Understand L2	Apply L3	Analyze L4	Evaluate L5	Create L6
CO1	Y	Y	Y	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	N	Y	N	N
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	2	3	1	-	3	-	-	-	-	-	-	-	-	3	-
CO3	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	3	2	-	-	-	-	3	3	2	-	-	-	3	-
CO5	2	2	2	-	-	-	-	3	-	3	3	-	-	3	-

PROJECT-IV [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Subject Code	22PRJ49	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

- Get exposure about the electronics hardware and various software tools.
- Design the working model of the open ended problem.
- Understand concepts of Packaging.
- Understand the latest technology trends in the PCB design.
- Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

Course outcomes: After studying this course, students will be able to:

CO1-Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO2-Analyze the various existing solutions available to solve the real time problem and propose the best solution.

CO3-Design and implement the system to solve the real time problem of the society.

CO4-Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO5- Use the modern tool available like advanced hardware and software tools.

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	**Y**	**Y**	**Y**	N	N	N
CO2	**Y**	**Y**	N	Y	N	**N**
CO3	**Y**	**Y**	N	**N**	N	Y
CO4	**Y**	**Y**	N	N	N	N
CO5	**Y**	**Y**	N	**N**	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	3	2	-	-	2	2	-	-	3	3	-	3	-	3	-
CO2	3	3	1	-	-	-	-	-	-	-	-	3	-	3	-
CO3	3	3	3	2	3	2	2	-	3	3	2	3	-	3	-
CO4	3	3	3	2	-	-	-	3	3	3	3	3	-	3	-
CO5	-	-	-	-	3	-	-	3	3	3	3	3	-	3	-

UNIVERSAL HUMAN VALUES

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22UHV410	CIE Marks	50
Number Lecture Hour/Week	2L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Module -1	**Teaching Hours**
Introduction to Value Education: Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) **Lecture 2:** Understanding Value Education **Tutorial 1**: **Practice Session PS1** Sharing about Oneself **Lecture 3:** Self-exploration as the Process for Value Education **Lecture 4:** Continuous Happiness and Prosperity – the Basic Human Aspirations **Tutorial 2: Practice Session PS2** Exploring Human Consciousness **Lecture 5:** Happiness and Prosperity – Current Scenario **Lecture 6:** Method to Fulfill the Basic Human Aspirations **Tutorial 3: Practice Session PS3** Exploring Natural Acceptance	**08 Hours**
Module -2	
Module 2 – Harmony in the Human Being (6 lectures and 3 tutorials for practice session) **Lecture 7:** Understanding Human being as the Co-existence of the Self and the Body **Lecture 8:** Distinguishing between the Needs of the Self and the Body **Tutorial 4:** Practice Session PS4 Exploring the difference of Needs of Self and Body **Lecture 9:** The Body as an Instrument of the Self **Lecture 10:** Understanding Harmony in the Self **Tutorial 5:** Practice Session PS5 Exploring Sources of Imagination in the **Self** **Lecture 11:** Harmony of the Self with the Body **Lecture 12:** Programme to ensure self-regulation and Health **Tutorial 6:** Practice Session PS6 Exploring Harmony of Self with the Body	**08 Hours**
Module -3	
Harmony in the Family and Society (6 lectures and 3 tutorials for practice session) **Lecture 13:** Harmony in the Family – the Basic Unit of Human Interaction **Lecture 14:** 'Trust' – the Foundational Value in Relationship **Tutorial 7:** Practice Session PS7 Exploring the Feeling of Trust **Lecture 15:** 'Respect' – as the Right Evaluation **Tutorial 8:** Practice Session PS8 Exploring the Feeling of Respect **Lecture 16:** Other Feelings, Justice in Human-to-Human Relationship **Lecture 17:** Understanding Harmony in the Society **Lecture 18:** Vision for the Universal Human Order	**08 Hours**

Module -4	
Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) **Lecture 19:** Understanding Harmony in the Nature **Lecture 20:** Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature **Tutorial 10: Practice Session PS10** Exploring the Four Orders of Nature **Lecture 21:** Realizing Existence as Co-existence at All Levels **Lecture 22:** The Holistic Perception of Harmony in Existence **Tutorial 11: Practice Session PS11** Exploring Co-existence in Existence	**08 Hours**
Module-5	
Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session) **Lecture 23: Natural Acceptance of Human Values** **Lecture 24:** Definitiveness of (Ethical) Human Conduct **Tutorial 12: Practice Session PS12** Exploring Ethical Human Conduct **Lecture 25:** A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order **Lecture 26**: Competence in Professional Ethics **Tutorial 13: Practice Session PS13** Exploring Humanistic Models in Education **Lecture 27:** Holistic Technologies, Production Systems and Management Models-Typical Case Studies **Lecture 28:** Strategies for Transition towards Value-based Life and Profession **Tutorial 14: Practice Session PS14** Exploring Steps of Transition towards Universal Human Order	**08 Hours**

Course Outcomes: After studying this course, students will be able to:

CO1-Develop and propose sustainable solutions to address societal and environmental challenges.

CO2-Ensure the feasibility of these solutions and create detailed roadmaps to implement them effectively.

CO3-Utilize acquired knowledge in technology, engineering, management, or other fields to promote mutual benefits, such as creating systems that positively impact both society and nature.

CO4- Critically assess the course content and share insights with peers, while suggesting improvements to enhance its effectiveness and relevance.

CO5- Apply the knowledge gained from the course to foster a prosperous and harmonious family and societal life.

Text Books:

1. The Textbook - A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. The Teacher's Manual- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English).

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	-	-	-	-	-	3	3	2	-	-	-	2	-	-	-
CO2	-	-	-	-	-	3	2	2	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	3	2	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	2	3	-	-
CO5	-	-	-	-	-	3	-	2	-	-	-	2	3	-	-

EMBEDDED C BASICS

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Laboratory Code	22AEC411A	CIE Marks	50
Number of Practical Sessions/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS – 01

Course Learning Objectives: Students will be taught to:

- Develop the microcontroller-based programs for various applications using embedded C.

Laboratory Experiments

Conduct the following experiments by writing C Program using Keil microvision simulator (any 8051 microcontrollers can be chosen as the target).

1. Write a 8051 C program to multiply two 8 bit binary numbers.
2. Write a 8051 C program to find the sum of first 10 integer numbers.
3. Write a 8051 C program to find factorial of a given number.
4. Write a 8051 C program to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5. Write a 8051 C program to find the square of a number (1 to 10) using look-up table.
6. Write a 8051 C program to find the largest/smallest number in an array of 32 numbers
7. Write a 8051 C program to arrange a series of 32 bit numbers in ascending/descending order
8. Write a 8051 C program to count the number of ones and zeros in two consecutive memory locations.
9. Write a 8051 C program to scan a series of 32 bit numbers to find how many are negative.
10. Write a 8051 C program to display "Hello World" message (either in simulation mode or interface an LCD display).

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Learning Resources: "The 8051 Microcontroller: Hardware, Software and Applications", V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education, 1st edition, 2017

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING (Y/N)

COURSE OUTCOME	Remember L1	Understand L2	Apply L3	Analyze L4	Evaluate L5	Create L6
CO1	**Y**	**Y**	**Y**	N	N	N
CO2	**Y**	**Y**	Y	N	N	**N**
CO3	**Y**	**Y**	N	**Y**	N	N
CO4	**Y**	**Y**	N	N	N	N
CO5	**Y**	**Y**	N	**N**	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2	PSO.3
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

PCB DESIGN AND FABRICATION

[As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme]

SEMESTER-IV

Subject Code	22AEC411B	CIE Marks	50
Number of practical Hours/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

- Acquire the knowledge of fabrication process in current trending technological electronic world.
- Learn the designing of circuits for PCB.
- Learn the Fabrication and Itching of PCB.
- Learn the trouble shooting of any kind of faults in PCB.
- Acquire the necessary employable skills.

Laboratory Experiments

1. Study of basic electronics components.
2. Study the basic functionality of PCB designing CAD software (PCB EXPRESS)
3. Study the basic fabrication process
4. Study the basic Etching process
5. Applications of PCB designing, Etching & fabrication.
6. Design, Etch and fabricate the LED switch circuit.
7. Design, Etch and fabricate the circuit for regulate the speed of fan.
8. Design, etch and fabricate the circuit for touch switch circuit.
9. Design, etch and fabricate the circuit for non-contact AC Voltage Detector.
10. Design, etch and fabricate the circuit for Simple Water Level Indicator.

Course Outcomes: After studying this course, the students will be able to:

CO1-Develop a strong foundation in applying theoretical concepts by designing /simulating the experiment.

CO2-Utilize laboratory instruments/simulation tools to build and test experiments.

CO3-Analyze experimental data/simulation results and interpret findings to draw meaningful conclusions.

CO4-Learn to work effectively in teams while identifying and correcting faults in electronic circuits/programs.

CO5-Manage time effectively in a simulation/laboratory environment, balancing experimental work, data collection, and report writing within specified deadlines.

Reference material information

1. R.S Khandpur, "Printed Circuit Boards - Design, Fabrication, Assembly and Testing," 1st Edition, TMH, 2017.

2. Walter C. Bosshart, "Printed Circuit Boards- Design and Technology," McGraw Hill Education,1983.

3. Clyde F. Coombs, "Printed Circuits Handbook," 6th Edition, McGraw Hill Education, 2007.

4. Kraig Mitzner, "Complete PCB Design Using Or CAD Capture and PCB Editor," 2nd Edition, Academic Press, 2019.

5. Rao R. Tummala, "Introduction to System-on-Package (SOP): Miniaturization of the Entire System," McGraw Hill, 2008.

6. Mark I. Montrose, "EMC and the Printed Circuit Board-Design, Theory and Layout Made simple," 1st Edition, Wiley-IEEE Press, 1998. 2013.

3. G. C. Loveday, "Electronic fault diagnosis," Pearson Education, 1994

COURSE OUTCOME AND REVISED BLOOM'S TAXONOMY LEVEL MAPPING						
COURSE OUTCOME	**Remember L1**	**Understand L2**	**Apply L3**	**Analyze L4**	**Evaluate L5**	**Create L6**
CO1	Y	Y	N	N	N	N
CO2	Y	Y	Y	N	N	N
CO3	Y	Y	N	N	N	Y
CO4	Y	Y	N	N	N	N
CO5	Y	Y	N	N	N	N

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):
Note: 1-Low, 2-Medium, 3-High

CO/PO	**PO.1**	**PO.2**	**PO.3**	**PO.4**	**PO.5**	**PO.6**	**PO.7**	**PO.8**	**PO.9**	**PO.10**	**PO.11**	**PO.12**	**PSO.1**	**PSO.2**	**PSO.3**
CO1	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO2	**2**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**-**

ADDITIONAL MATHEMATICS – II [As per Choice Based Credit System (CBCS) Scheme] SEMESTER- IV			
Subject Code	22MATDIP41	CIE Marks	00
Number of Lecture Hour/Week	4L	SEE Marks	100
Number of Lecture Hours	40	Exam Hours	03
CREDITS-00			

Course Objectives: This course will enable students to:

- Solve first order differential equations. .
- Solve second and higher order differential equations.
- Understand and solve the partial differential equation.
- To acquire the knowledge of elementary probability theory.
- Know the basic concepts of evaluation of double and triple integrals.

Module -1	**Teaching Hours**
Differential Equation-1: Solution of first order and first degree differential equations: Variable separable, Homogeneous, Exact and Reducible to exact differential equation, Linear differential equation. Applications of first order first degree differential equations: Newton's law of cooling.	08 Hours
Module -2	
Differential Equations-2: Solution of second & higher order Ordinary linear differential equation with constant co-efficients. Method of variation of parameters. Solution of homogeneous LDE by Power series solution Method.	08 Hours
Module -3	
Partial Differential Equations(PDE's): Formation of PDE by eliminating arbitrary constant & functions, Solution of Non-homogeneous PDE by direct integration, solution of homogeneous PDE with respect to one independent variable only. Derivation of one dimensional wave equation and heat equation and Various possible solution of wave & heat equations by methods of separation of variables.	08 Hours
Module -4	
Improper Integrals: Beta and gamma functions and its properties and examples. Evaluation of double integral over a specific region, changing the order of integration , changing into polar form.	08 Hours
Module -5	
Probability: Introduction , Sample space and Events. Axioms of Probability, Addition & Multiplication theorems. Conditional probability- illustrative examples. Baye's theorem- examples.	08 Hours

Course Outcomes: After studying this course, students will be able to:

CO1-Solve first order differential equations in the different areas of Engineering.

CO2-Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.

CO3-Solve second order partial differential equations in the different areas in the real world.

CO4-Recall basic concepts of elementary probability theory and, solve problems related to the decision theory, synthesis and optimization of digital circuits. CO5-To find the surface area and volume of 3D objects.

Text Books:

1. *B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015*

Reference Books:

1. *E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.*
2. *N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers, 7th Ed., 2007.*

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

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

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO5	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**