ENGINEERING MATHEMATICS –III FOR ECE & EEE Branch			
Course Code	21MAT31	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 engineering fields.
- 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: LAPLACE TRANSFORMS	
Laplace Transforms: Definition, Laplace transforms of Elementary functions, properties(without proof) periodic function, Unit step function, Unit impulse function. **Inverse Laplace Transforms:** Definition, Convolution Theorem (without proof) and Finding Inverse Laplace transform by convolution Theorem. Solution of Linear Differential equations using Laplace Transforms and Applications (5 Assignment Problem). **Self Study : Solution of first order simultaneous differential equation** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-2: PROBABILITY DISTRIBUTION-1	
Probability Distribution: Random variables (discrete and continuous) probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and Normal distributions. Problems. (5 Assignment Problem). **Self Study : Definition of probability , addition and multiplication rule, Bay's theorem.** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-3: STATISTICAL METHODS	
Statistical Methods: Correlation-karl Pearson's co-efficient of correlation problems. Regression analysislines of regression, Rank correlation (without proof)-problems. **Curve Fitting:**Curve fitting by the method of least square. Fitting of the curves of the form$y = ax + b$, $y = ax^2 + bx + c$ & $y = ae^{bx}$. **Numerical Methods:** Numerical solution of algebraic and transcendental equations by Regula-Falsi Method and Newton-Raphson method. (5 Assignment Problem). **Self Study : Secent method, mean, mode, median, variance and standard deviation.** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-4: FINITE DIFFERENCES	
Finite Difference: Forward and Backward differences, Newton's forward and backward interpolation formulae. Divided difference-Newton's divided difference formulae. Lagrange's-interpolation formula and inverse interpolation formula (all formula without proof) problems. **Numerical Integration:** Simpsons $\left(\frac{1}{3}\right)^{rd}$, $\left(\frac{3}{8}\right)^{th}$ rules, Weddle's rule (without proof) problems (5 Assignment Problems). **Self Study :** Numerical differentiation, Trapezoidal rule	**8 Hours**

(RBT Levels: L1, L2 and L3)	
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-5: Z-TRANSFORMS AND LINEAR ALGEBRA

Z- Transforms: Difference Equations, Basic definitions, Damping rule, Shifting rule, Initial and FinalValue theorems (without proof) and problems. Inverse Z-transforms. Applications of Z-transforms to solve difference equation. **Linear Algebra:** Introduction to Vector space and sub space, definitions, illustrative examples and simple problems, Basis and dimensions, Linear independent and linear dependent vectors **Self Study : Two dimensional and three dimensional vectors, convergent and divergent series** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

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 Outcomes(COs): After completion of course, the student will able to

- **CO1 -** Apply the knowledge of Laplace transform from time domain to frequency domain in Signal and image processing and to find inverse Laplace transform.
- **CO2 -** Learn to solve the random variable in both discrete and continuous and their probability distribution, Mass on various engineering problems.
- **CO3 -** Make the use of the concept of correlation and regression lines for solving the problems and numerical techniques to solve engineering problems.
- **CO4 -** Understanding the concepts of Finite differences to solve the problems on interpolation.
- **CO5 -** 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

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 :

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

CO5												1
AVG	3	2										1

Text Books:

1. B.S. Grewal : Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. C.Ray Wylie, Louis C.Barrett : “Advanced Engineering Mathematics", 6th Edition,
2. McGraw-Hill Book Co., New York, 1995.
2. James Stewart : “Calculus –Early Transcendentals”, Cengage Learning India Private Ltd.,2017.
3. B.V.Ramana : "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Srimanta Pal &Subobh C Bhunia:“Engineering Mathematics”, Oxford UniversityPress,3rd Reprint,2016.
5. Gupta C.B., Singh S.R. and Mukesh Kumar : “Engineering Mathematics for Semester I & II”, Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math
3. http://academicearth.org.

ANALOG CIRCUITS

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

SEMESTER-III

Subject Code	21EC32	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:

1. Understand and analyze the AC and DC operation of BJT & FET.
2. Understand the basic concepts of operational amplifier.
3. Understand and analyze the AC and DC operation of Op-Amp.
4. 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**)	**10 Hours**

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**)	

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

CO-1-Analyze DC and AC operation of BJT and JFET biasing circuits.

CO-2-Explain the characteristics of Op-Amp and design the AC and DC amplifiers using Op-Amp.

CO-3-Develop linear applications and Switching circuits.

CO-4-Develop the signal processing circuits, sinusoidal oscillators and active filters using Op-Amp.

CO-5- 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, SatyabrataJit, "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	21EC33	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)**	**8Hours**
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)**	**8Hours**
Module3	
Principles of Sequential Circuits: Introduction, BasicBi-stable elements, Latches,The Master-S-lave flip-flops (pulse-triggered flip-flops): SR flip-flops,JKflip-flops, Characteristic equations. **(Text 2- Chapter 6)**	**8Hours**
Module4	
ApplicationsofSequentialCircuits: Registers,Binaryripplecounters,Synchronousbinarycounters, Counters based on shift registers, Design of synchronous counters, Design of asynchronousmod-n counterusing clocked T, JK, D and SR flip-flops.**(Text 2- Chapter 6)**	**8Hours**
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)**	**8Hours**
Course Outcomes: After studying the course students will be able to: CO-1- Apply the Karnaugh map method to derive minimal forms of Boolean expressions in digital systems. CO-2- Design and implement various combinational circuits. CO-3-Analyze the various latches and flip-flops using their characteristic equations. CO-4- Design and develop sequential counters and shift registers using flip-flops. CO-5- Design Mealy and Moore models along with state diagrams to analyze clocked sequential circuit.	
TextBooks: 1. DigitalLogicApplicationsandDesign,JohnMYarbrough,ThomsonLearning,2001.ISBN981-240-062-1. 2. DonaldD.Givone,―DigitalPrinciplesandDesign‖,McGrawHill,2002.ISBN978-0-07-052906-9.	

3. Charles H Roth Jr., Larry L.Kinney – Fundamentals of Logic Design, Cengage Learning, 7th Edition.	
ReferenceBooks: 1. D.P.KothariandJ.SDhillon,DigitalCircuitsandDesign‖,Pearson,2016,ISBN:9789332543539 2. Morris Mano, ―DigitalDesign,PrenticeHallofIndia,ThirdEdition.	

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	21EC34	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:

1. Understand the concepts of transformation techniques, mesh and Nodal analysis of DC circuits.
2. Apply the knowledge of basic circuit law to simplify the networks using network theorems and explain design concept of attenuators and filters
3. Explain importance of series and parallel resonance circuits.
4. Impart the basic knowledge of network analysis using Laplace transforms.
5. 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, derivationandnumericals 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:

CO-1- Analyze the basic concepts, laws, and methods for DC network analysis. Simplify the network using transformation and shifting techniques.

CO-2- Apply network theorems to solve complex electrical circuits.

CO-3- Develop simple passive filters and attenuators for given specifications.

CO-4- Design series and parallel resonance circuits, and synthesize typical waveforms using the Laplace transform.

CO-5- Determine the performance parameters of a two-port network.

Text Books:

1. M.E.VanValkenberg(2000),—Network analysis, Prentice Hall of India, 3rdedition, 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	21EC35	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	30	Exam Hours	03

CREDITS-02

Course Objectives: This course will enable students to:

1. Provide the fundamental knowledge about sensors and measurement system.
2. Factors in selection of instruments for measurement. To discuss the principle, design and working of transducers for the measurement of physical time.
3. Know usage of different transducers in the measurement of temperature, displacement and level measurement applications.
4. Varying quantities. Understand the working of various actuators suitable in industrial process control systems.
5. Understand the principle and application of smart sensors.

Module -1	**Teaching Hours**
Sensors and measurement system: Sensors and transducers, Classifications of transducers-primary & secondary, active & passive, analog and digital transducers. Smart sensors. Measurement: Definition, significance of measurement, instruments and measurement systems. mechanical, electrical and electronic instruments. Elements of generalized measurement system with example. Input-output configuration of measuring instruments and measurement systems, methods of correction for interfering and modifying inputs.	**6 Hours**
Module -2	
Measurement of Displacement: Introduction, Principles of Transduction, Variable resistance devices, variable Inductance Transducer, Variable Capacitance Transducer, Hall Effect Devices, Proximity Devices, Digital Transducer,	**6 Hours**
Module -3	
Measurement of Temperature: RTD, Thermistor, Thermocouple, laws of thermocouple, Thermopile, AD590. Measurement of Force & Torque: Introduction, Force measuring sensor –Load cells – column types devices, proving rings, cantilever beam, pressductor. Hydraulic load cell, electronic weighing system.	**6 Hours**
Module -4	
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. Pneumatic Actuators: Principle and working of pneumatic actuators. (Numerical problems on the topic).	**6 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. Hydraulic Actuators: Principle and working of Hydraulic actuators. (Numerical problems on the topic).	**6 Hours**

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

CO-1-Discuss the fundamental concepts related to sensors and measurements and apply them for characterizing measurement systems.

CO-2-Apply the suitable transducers for measurement of displacement.

CO-3-Apply the suitable transducers for measurement of temperature, force & torque

CO-4-Discuss the fundamental concepts of process control system and analyze the process control systems.

CO-5-Analyze actuators operation in control systems.
Reference Books: 1. Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 17th Edition, (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004. 2. Instrumentation: Devices and Systems, C S Rangan, G R Sarma, V S V Mani, 2nd Edition (32 Reprint), McGraw Hill Education (India), 2014. 3. Process Control Instrumentation Technology by 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	N	N	N
CO3	Y	Y	Y	N	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**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

ANALOG CIRCUITS LABORATORY

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

SEMESTER-III

Subject Code	21ECL36	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory oratory course will enable students to:

1. Characterize the JFET and MOSFET.
2. Design and evaluate the BJT amplifier.
3. Design and realize the various Op-Amp applications.
4. Design and realize Monostable and Astable multivibrator using 555 Timer.
5. 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 Astablemultivibrator 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 oratory 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 oratory 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	21ECL37	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	20	Exam Hours	03

CREDITS-01

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

1. Demorgan‘s Theorem, SOP, POS forms
2. Full/Parallel Adders, Subtractors and Magnitude Comparator
3. Multiplexer, Demultiplexers, encoder and Decoders applications
4. 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. 11any 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/Subtractorusing 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 oratory 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 oratory 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	21ECL38	CIE Marks	50
Number of practical Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Realize the basic laws, KVL and KCL.
2. Realize the network theorems.
3. Calculation of frequency response, Quality, bandwidth for both series & parallel resonant circuits.
4. Analysis and understand locus diagram.
5. 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 oratory 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 oratory 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	21PRJ39	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives: This course will enable students to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. 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:

CO-1-Apply the knowledge of electronics hardware and software components to solve the real time problems of the society.

CO-2-Analyze the various existing solutions avail laboratory le to solve the real time problem and propose the best solution.

CO-3-Design and implement the system to solve the real time problem of the society.

CO-4-Conduct investigations on the output and prepare the technical documentation of the designed system in a team.

CO-5-Use the modern tool avail laboratory le 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**	**-**

KANNADA KALI-III

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

SEMESTER-III

Subject Code	18KANKK310	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Number of Lecture Hours	14	Exam Hours	03

CREDITS-01

Course Objectives:

- ಅನ್ಯಭಾಷಿಕ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಮಾತನಾಡುವುದು ಬರೆಯುವ ಕೌಶಲ್ಯ ಕಲಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಬರವಣಿಗೆ ಕುರಿತು ತಿಳುವಳಿಕೆ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ನಾಡು ನುಡಿ, ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ತಿಳಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಪ್ರೇಮವನ್ನು ಬೆಳೆಸುವುವುದು.

Module -1	**Teaching Hours**
Lesson 1: Conversation 1, Conversation 2, Conversation 3,Vocabulary,Exercises. **Lesson 2:**Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -2	
Lesson 3: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson 4:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -3	
Lesson 5: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson 6:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises..	03 Hours
Module -4	
Lesson 7: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson8:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -5	
Lesson 9: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson 10:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	02 Hours

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ, ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

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

CO1-To understand the necessity of local language for comfortable life.

CO2-To speak, read write kannada language as per requirement.

CO3-To communicate [converse] in kannada language in their daily life with kannada speakers.

CO4-To listen and understand the kannada language properly.

CO5-To speak in polite conservation.

ಆಧಾರ ಗ್ರಂಥಗಳು:

1) ಕನ್ನಡ ಕಲಿ – ಪ್ರೊ.ನಾನಾಸಾಹೇಬ ಹಚ್ಚಡದ ಪ್ರಸಾರಾಂಗ ಶರಣಬಸವ ವಿಶ್ವವಿದ್ಯಾಲಯ ಕಲಬುರಗಿ
2) ಮಾತಾಡುಕನ್ನಡ – ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್ತು – ಬೆಂಗಳೂರು

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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	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3

AAYDAKATEGALU

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

SEMESTER-III

Subject Code	20KANKK310	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Number of Lecture Hours	14	Exam Hours	03

CREDITS-01

Course Objectives:

- ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಬರವಣಿಗೆ ಕುರಿತು ತಿಳುವಳಿಕೆ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ನಾಡು ನುಡಿ, ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ತಿಳಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಪ್ರೇಮವನ್ನು ಬೆಳೆಸುವುವುದು.

ಘಟಕ1 (Module 1)	**ಉಪನ್ಯಾಸ ಅವಧಿ Teaching Hours**
೧) ಮೊಸರಿನ ಮಂಗಮ್ಮ– ಮಾಸ್ತಿ ವೆಂಕಟೇಶಐಯ್ಯಂಗಾರ (ಶ್ರೀನಿವಾಸ) ೨) ಕೊನೆಯಗಿರಾಕಿ – ನಿರಂಜನ	03 Hours
ಘಟಕ2 (Module 2)	
೧) ದಾರಿ–ಚಿತ್ರಶೇಖರಕಂಠಿ ೨) ಮಾಗಿ– ಕೇಶವ ಮಳಗಿ.	03 Hours
ಘಟಕ3 (Module 3)	
೩) ಕಾಡು – ಸಿದ್ದರಾಮ ಹೊನ್ಕಲ್ ೪) ಆಸೆಯೆಂಬ ತಥಾಗತನ ವೈರಿ–ಚಿದಾನಂದ ಸಾಲಿ	03 Hours
ಘಟಕ4 (Module 4)	
೫) ತಬ್ಬಲಿಗಳು –ರಾಘವೇಂದ್ರ ಖಾಸನೀಸ ೬) ನಿವೃತ್ತರು – ಪಿ.ಲಂಕೇಶ	03 Hours
ಘಟಕ5 (Module 5)	
೭) ಅಬಚೂರಿನ ಪೋಸ್ಟಾಫೀಸು–ಕೆ.ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ ೮) ಹಂಗಿನರಮನೆಯ ಹೊರಗೆ–ರಾಜಶೇಖರ ನೀರಮಾನ್ವಿ	02 Hours

Course Outcome

1) ಕನ್ನಡ ಸಾಹಿತ್ಯ ಬಗ್ಗೆ ಅರಿತುಕೊಳ್ಳುತ್ತಾರೆ.
2) ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಮಹತ್ವವನ್ನು ತಿಳಿದುಕೊಳ್ಳುತ್ತಾರೆ.
3) ಭಾಷಾಭಿಮಾನವನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾರೆ.
4) ಕನ್ನಡ ಸಾಹಿತ್ಯ ಕೃತಿಗಳ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
5) ಕನ್ನಡ ಕಥೆಗಳ ಬಗ್ಗೆ ಅರಿತುಕೊಳುತ್ತಾರೆ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು :

1) ಆಯ್ದ ಕಥೆಗಳು : ಪ್ರೊ. ನಾನಾಸಾಹೇಬ ಎಸ್, ಹಚ್ಚಡದ ಪ್ರಸಾರಾಂಗ ಶರಣಬಸವ ವಿಶ್ವವಿದ್ಯಾಲಯ ಕಲಬುರಗಿ

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	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3

ANALOG ELECTRONICS LABORATORY USING PSPICE/MULTISIM/LTSPICE

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

SEMESTER-III

Subject Code	21EC311	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Practical Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory oratory course will enable students to:

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

Experiments using Pspice/Multisim/LTspice software

List of Experiments:

13. Realize JFET/MOSFET characteristics.
14. Realize BJT amplifier circuit and obtain the frequency response characteristics.
15. Design and realize Inverting and Non inverting amplifier using Op-Amp.
16. Realize RC phase shift oscillator using Op-Amp.
17. Realize Wein bridge oscillator using Op-Amp.
18. Realize the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
19. Realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
20. Design and verify a Precision full wave rectifier.
21. Design and realize Monostable and Astable multivibrator using 555 Timer.
22. 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 oratory 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 oratory 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 LABORATORY USING PSPICE/MULTISIM/LTSPICE

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

SEMESTER-III

Subject Code	21EC312	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
		Exam Hours	03

CREDITS-01

Course Objectives: This laboratory oratory course will enable students to:

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

Experiments using Pspice/Multisim/LTspice software

List of Experiments:

1. Verify
   (a) DeMorgan'sTheoremfor two variables.
   (b) Thesum-ofproductandproduct-of-sumexpressionsusinguniversalgates.
2. Design and implement
   (a) HalfAdder.
   (b) FullAdder.
   (c) FullSubtractor.
3. Designandimplement4-bitParallelAdder/Subtractorusing IC7483.
4. Designandimplement3-bit Binary to Gray code converter.
5. Realize a 4-variable function using IC 74151 (8:1 MUX)
6. Realize Adder/Subtractorusing IC 74139
7. Designand Implementationof4-bitMagnitudeComparatorusing IC7485.
8. Realizethefollowing shiftregistersusingIC7474/IC7495
   (a) SISO(b)SIPO(c)PISO(d)PIPO
9. RealizeRingandJohnsoncounter.
10. RealizeMod-N Asynchronous/Synchronouscounter.

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 oratory 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 oratory 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	18MATDIP31	CIE Marks	00
Number of Lecture Hour/Week	3L+1T	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	21MAT41	**CIE Marks**	50
Contact Hours/Week	03	**SEE Marks**	50
Total Hours	40	**Exam Hours**	03
Semester	IV	**Credits**	03

Course Learning Objectives:

This course will enable students to:

- Learn Fourier series and Fourier transforms.
- Conversant with numerical methods to solve ordinary differential equations.
- Understand Joint probability distribution and stochastic processes arising in science and engineering.
- Understand the definition of sequence, series and its importance.
- Know the finite difference method and use in solving partial differential equation.

MODULE-1: FOURIER SERIES	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions wit period 2π and with arbitrary period 2c. Fourier series of even and odd functionsHalf 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**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-2: PROBABILITY DISTRIBUTIONS-2	
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. (5 Assignment Problem). **Self Study : Joint probability distribution for continuous random variable** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-3: NUMERICAL METHODS-1	
Numerical Methods: Numerical solution of ordinary differential equations of first order and first degree, Taylor's series method, modified Euler's-method Runge - Kutta method of fourth order. Milne's and Adams- Bashforth predictor and corrector methods (No derivations of formulae). (5 Assignment Problem). **Self Study : Picards method** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-4: NUMERICAL METHODS-2	
Numerical Methods: Numerical solution of second order ordinary differential equations, Runge-Kutta Method and Milne's Method, Numerical solution of P.D.E: Numerical solution of Heat equation, Wave equation, problems. (5 Assignment Problem). **Self Study : Picard's method, Numerical solution of Laplace's equation** **(RBT Levels: L1, L2 and L3)**	**8 Hours**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

MODULE-5: Fourier Transforms and complex variable

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier-transform (5 Assignment Problem). **Complex line Integrals:** Cauchy's Integration theorem, Cauchy integral formula, Laurent's Series, typesof 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**
Teaching – Learning Process	Chalk and talk method / Power Point Presentation

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 =Internal Assessment + 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 Outcomes(Cos) : After completion of course, the student will able to

CO1- Understanding the Periodic function and Fourier series expansion of different functions and its application to analyze circuits.

CO2- Learn to solve the problems on Joint probability distribution and to know the concept of stochastic processes and Markov's chains in discrete time.

CO3- Solving the first order first degree ordinary differential equations arising in flow problems by numerical methods.

CO4- Make the use of second order ordinary and partial differential equations arising in heat and wave equations by numerical methods.

CO5- Apply the knowledge of Fourier transform and Understand the complex potentials in different engineering fields.

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 :

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

CO3	3	2										1
CO4	3	2										1
CO5	3	2										1
AVG	3	2										1

Text Books:

1. B.S. Grewal : Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. C.Ray Wylie, Louis C.Barrett : “Advanced Engineering Mathematics", 6th Edition,
2. McGraw-Hill Book Co., New York, 1995.
2. James Stewart : “Calculus –Early Transcendentals”, Cengage Learning India Private Ltd., 2017.
3. B.V.Ramana : "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Srimanta Pal & Subobh C Bhunia:“Engineering Mathematics”, Oxford University Press,3rd Reprint,2016.
5. Gupta C.B., Singh S.R. and Mukesh Kumar : “Engineering Mathematics for Semester I & II”, Mc-Graw Hill Education (India) Pvt.Ltd., 2015.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math
3. http://academicearth.org.

ANALOG AND DIGITAL COMMUNICATION

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

SEMESTER-IV

Subject Code	21EC42	CIE Marks	50
Number Lecture Hour/Week	3L+1T	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: The objectives of the course is to enable students to:

1. Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
2. Understand the concepts in Angle modulation for the design of communication systems.
3. Design simple systems for generating and demodulating frequency modulated signals. ·
4. 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, Baseband Representation of Modulated Waves and Band-Pass Filters (Text 1: 3.1 to 3.7).	**10 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, FM pre-emphasis and De-emphasis(Text 1: 9.7,9.8). **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 to 5.4).	**10 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).	**10 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)	**10 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, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).	**10 Hours**

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

CO-1- Comprehend and analyze the basic principles of Amplitude Modulation (AM).

CO-2- Apply the knowledge of sampling and analyze Angle modulation techniques used in communication systems.
CO-3- Examine inter-symbol interference (ISI) and understand the role of the Nyquist channel in baseband transmission.
CO-4- Generation and detection of signals using digital band pass modulation techniques
CO-5- 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	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	-	-	-	-	-	-	-	-	-	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	21EC43	CIE Marks	50
Number of LectureHours/Week	3L	SEE Marks	50
Total Number ofLecture Hours	40	Exam Hours	03

CREDITS-03

Course objectives: This course will enable students to:

1. Understandthe basics of microcontroller, Embedded systems and architecture of 8051 microcontroller.
2. Explain and analyze the instruction sets of 8051 microcontrollers and also to write the AssemblyLevelProgramsusing8051Instructionset.
3. Understand and write peripheral programming for Timers, Serial Port and Interrupt system of 8051.
4. Analyze the Application and Interfacing of8051MicrocontrollertoI/Odevices.

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	
8051Instruction 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:

CO-1- Demonstrate the basics of microcontrollers and embedded systems, including the architecture of the 8051 microcontrollers.
CO-2-Explore the instruction set of 8051 microcontrollers.
CO-3-Develop the programs using the 8051-microcontroller instruction set.
CO-4- Develop programs for timers, counters, serial communication and interrupts in 8051 icrocontrollers.
CO-5- 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	21EC44	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:

1. Understand the classification of signals into different categories based on their properties. Explain basic operations on signals and properties of systems.
2. Use convolution in both continuous and discrete domains for the analysis of systems given the impulse response of a system.
3. Evaluate response of a given linear time invariant system and Fourier representation of periodic signals.
4. Apply continuous time Fourier transform representation and discrete time Fourier transform representation to study signals and linear time invariant systems.
5. 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**

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.

CO-4- Examine the spectral characteristics of continuous and discrete-time signals using Fourier analysis.

CO-5- 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	21EC45	CIE Marks	50
Number Lecture Hour/Week	2L	SEE Marks	50
Number of Lecture Hours	30	Exam Hours	03

CREDITS-02

Course Objectives: Students will be taught to:

6. Provide an insight into the concept of information in the context of communication theory and its significance in the design of communication receivers.
7. Study various source encoding algorithms.
8. Model the communication channels.
9. 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)	**06 Hours**
Module -2	
Source Coding: Encoding of the source output: Shannon's Encoding Algorithm. (Section 4.3 of Text 1) Source coding theorem: Prefix Codes, Kraft-McMillan inequality property, Huffman codes. (Section 2.2,2.3 of Text 2)	**06 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)	**06 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)	**06 Hours**
Module-5	
Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree. (Section 8.5 of Text 2)	**06 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.

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 LABORATORY [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Subject Code	21ECL46	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

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

Laboratory oratory 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 bandlimited 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 oratory 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 oratory 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**	**-**

MICROCONTROLLERS LABORATORY

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

SEMESTER-IV

Subject Code	21ECL47	CIE Marks	50
Number of Practical Hour/Week	2P	SEE Marks	50
Number of Practical Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to :

1. Write 8051 application specific programs in Assembly Language and C for 8051.
2. Interface various hardware modules to 8051 Microcontrollerboard.
3. Use open source software tools like Keil and Flash magic.
4. 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 anarray.
4. Counters ---> For Hex and BCD up/ downcount.
5. Boolean and Logical Instructions. (BitManipulation).
6. Subroutines using CALL and RETURNInstructions.
7. Code Conversions ---> ASCII to Decimal, Decimal to ASCII, BCD toASCII

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. ADCInterfacing to8051 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 oratory 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 oratory 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 LABORATORY

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

SEMESTER-IV

Subject Code	21ECL48	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

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

Note: The experiments are to be carried using Matlaboratory / Scilaboratory / 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 oratory 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 oratory 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	21PRJ49	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. 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 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 availaboratory le 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 availaboratory le 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**	**-**

KANNADA KALI-4

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

SEMESTER-IV

Subject Code	18KANKK410	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Number of Lecture Hours	14	Exam Hours	03

CREDITS-01

Course Objectives:

- ಅನ್ಯಭಾಷಿಕ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಕನ್ನಡ ಮಾತನಾಡುವುದು ಬರೆಯುವ ಕೌಶಲ್ಯ ಕಲಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಬರವಣಿಗೆ ಕುರಿತು ತಿಳುವಳಿಕೆ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ನಾಡು ನುಡಿ, ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ತಿಳಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಪ್ರೇಮವನ್ನು ಬೆಳೆಸುವುವುದು.

Module -1	**Teaching Hours**
Lesson 1: Conversation 1, Conversation 2, Conversation 3, Vocabulary, Exercises. **Lesson 2:** Conversation 1, Conversation 2, Conversation 3, Vocabulary, Exercises.	03 Hours
Module -2	
Lesson 3: Conversation 1, Conversation 2, Conversation 3, Vocabulary, Exercises. **Lesson 4:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -3	
Lesson 5: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson 6:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -4	
Lesson 7: Conversation 1, Conversation 2, Conversation 3, Vocabulary, Exercises. **Lesson 8:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	03 Hours
Module -5	
Lesson 9: Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises. **Lesson 10:** Conversation 1, Conversation 2, Conversation 3,Vocabulary, Exercises.	02 Hours

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

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

CO1-To understand the necessity of local language for comfortable life.

CO2-To speak, read write kannada language as per requirement.

CO3-To communicate [converse] in kannada language in their daily life with kannada speakers.

CO4-To listen and understand the kannada language properly.

CO5-To speak in polite conservation.

ಆಧಾರ ಗ್ರಂಥಗಳು:

1) **ಮಾತಾಡುಕನ್ನಡ** – ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್– ಬೆಂಗಳೂರು

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
CO2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	3
CO5	-	-	-	-	-	-	-	1	-	-	3	-	-	-	3

MAHADASOHIGALU (ಮಹಾಚಾಸೋಹಿಗಳು)

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

SEMESTER-IV

Subject Code	20KANMD410	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Number of Lecture Hours	14	Exam Hours	03

CREDITS-01

Course Objectives:

- ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಬರವಣಿಗೆಕುರಿತು ತಿಳುವಳಿಕೆ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ನಾಡು ನುಡಿ, ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ತಿಳಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಪ್ರೇಮವನ್ನು ಬೆಳೆಸುವುವುದು.

ಘಟಕ1 (Module 1)	**Teaching Hours ಉಪನ್ಯಾಸಅವಧಿ**
1)ಶರಣಬಸವೇಶ್ವವರರ ಬದುಕು (ಅರಳಗುಂಡಿಗೆಯಲ್ಲಿ) 2)ಸಾಧನಾಕ್ಷೇತ್ರ (ಔರಾದ,ಪರ್ತಾಬಾದ್ ಮತ್ತು ಕಲಬುರಗಿಯಲ್ಲಿ)	03 Hours
ಘಟಕ2 (Module 2)	
3)ದೊಡ್ಡಪ್ಪಅಪ್ಪ ಹಾಗೂ ಶರಣಬಸವಪ್ಪಅವರ ಸಂಬಂಧಗಳು (1 ರಿಂದ6ನೇ ಪೀಠಾಧಿಪತಿಗಳು) 4)ಮರುಳ ಶರಣಬಸಪ್ಪ (ದೇವಾಲಯ ನಿರ್ಮಾಣ, ದಾಸೋಹ ಮಹಾಮನೆಯ ಬೆಳವಣಿಗೆ)	03 Hours
ಘಟಕ3 (Module 3)	
5)ಪೂಜ್ಯದೊಡ್ಡಪ್ಪಅಪ್ಪ (ಧಾರ್ಮಿಕ ಸಾಧನೆ) 6)ಶೈಕ್ಷಣಿಕ ಸಾಧನೆಗಳು	03 Hours
ಘಟಕ4 (Module 4)	
7) ಪೂಜ್ಯಡಾ. ಶರಣಬಸವಪ್ಪಅಪ್ಪ (ಸಾಮಾಜಿಕ ಕೊಡುಗೆಗಳು) 8) ಶೈಕ್ಷಣಿಕ ಕೊಡುಗೆಗಳು	03 Hours
ಘಟಕ5 (Module 5)	
9) ಮಹಾಮನೆಯ ಮಹಾ ಮಾತೆಯರು ಮೊದಲ ನಾಲ್ಕು ಪುಣ್ಯಸ್ತ್ರೀಯರು 10)ಐದನೆಯ ಪೀಠಾಧಿಪತಿಗಳಿಂದ 8ನೇ ಪೀಠಾಧಿಪತಿಗಳ ಪುಣ್ಯಸ್ತ್ರೀಯರು	02 Hours

Course Outcomes:

1) ಕನ್ನಡ ಸಾಹಿತ್ಯ ಬಗ್ಗೆ ಅರಿತುಕೊಳ್ಳುತ್ತಾರೆ.
2) ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನದ ಮಹತ್ವವನ್ನು ತಿಳಿದುಕೊಳ್ಳುತ್ತಾರೆ.
3) ಭಾಷಾಭಿಮಾನವನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾರೆ.
4) ಕನ್ನಡ ಸಾಹಿತ್ಯ ಕೃತಿಗಳ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
5) ಕನ್ನಡ ಕಥೆಗಳ ಬಗ್ಗೆ ಅರಿತುಕೊಳುತ್ತಾರೆ

ಆಧಾರ ಗ್ರಂಥ:

1. **ಮಹಾದಾಸೋಹಿಗಳು :**

ಪ್ರಧಾನ ಸಂಪಾದಕರು: ಮಾತೋಶ್ರೀ ಡಾ. ದಾಕ್ಷಾಯಣಿ ಎಸ್. ಅಪ್ಪ
ಸಂಪಾದಕರು. ಡಾ. ಎಂ. ಎಸ್. ಪಾಟೀಲ
ಪ್ರಸಾರಾಂಗ ಶರಣಬಸವ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕಲಬುರಗಿ

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	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
CO4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3

EMBEDDED C BASICS

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

SEMESTER-IV

Laboratory oratory Code	21AEC4111	CIE Marks	50
Number of Practical Sessions/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS – 01

Course Learning Objectives: Students will be taught to:

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

Laboratory oratory Experiments

Conduct the following experiments by writing C Program using Keilmicrovision 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 oratory 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 oratory 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 MallikarjunaSwamy, 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	21EC4112	CIE Marks	50
Number of practical Hours/Week	2P	SEE Marks	50
Total Number of Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: Students will be taught to:

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

Laboratory oratory 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 oratory 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 oratory 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**	**-**

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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

SEMESTER-V

Subject Code	21ES51	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives The objectives of the course is to enable students to:

- Understand basic skills of Management.
- Understand the need for Entrepreneurs and their skills.
- Identify the Management functions and Social responsibilities.
- Distinguish between management and administration.
- Understand Project identification and Selection.

Module -1	**Teaching Hours**
Management: Introduction-Meaning-Nature and characteristics of management, Scope and Functional areas of management- Management as art of science, art or profession-Management & Administration-Roles of Management, Levels of Management, Development of Management Thought-Early management approaches-Modern management approaches. **Planning**: Nature, importance and purpose of planning process objectives-types of plans (meaning only)-decision making, Importance of planning-steps in planning & planning premise- Hierarchy of plans.	08 Hours
Module -2	
Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalization, Committees–Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; **Staffing**-Need and Importance, Recruitment and Selection Process. **Directing:** Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioral Approach of Leadership;	08 Hours
Module -3	
Coordination: Coordination-Meaning, Types, Techniques of Coordination; **Controlling** – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process. **Authority delegation:**Meaning, advantage of effective delegation, barriers to effective delegation, guidelines for effective delegation. Decentralization: Decentralization of authority meaning, distinction between delegation and decentralization, the trade-off of centralization and decentralization.	08 Hours
Module -4	
Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models,	08 Hours

Entrepreneurial development cycle. **Modern Small Business Enterprises:** Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only) .	
Module -5	
Projects Management: A Project. Search for a Business idea: Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification: Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification: Feasibility Report, Project Feasibility Analysis. Project Formulation: Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation. **Project Design and Network Analysis:** Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.	08 Hours
Course Outcomes: After studying this course, students will be able to: CO1- Understand core principles of management and planning to effectively apply these concepts in real-world scenarios. CO2- Understand essential elements of Organizing, Staffing, and Directing and controlling, which are vital for effective management. CO3- Comprehend the key aspects of Social Responsibilities of Business and Entrepreneurship, with a focus on corporate governance and the entrepreneurial journey. CO4- Understand concepts, government policies, challenges, and entrepreneurial development. CO5- Explain Project management concepts, network analysis techniques, and the formulation and identification process for effective planning and execution.	
Text Books: 1. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4. 2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4. 3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978- 81-8488-801-2. 4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "Entrepreneurship", 8th Edition, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012	
Reference Books: 1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.	

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

DIGITAL SIGNAL PROCESING

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

Subject Code	21EC52	CIE Marks	50
Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Understand the frequency domain sampling and reconstruction of discrete time signals.
- Study the properties and the development of efficient algorithms for the computation of DFT.
- Learn the procedures to design of IIR filters from the analog filters using impulse invariance and bilinear transformation.
- Study the different windows used in the design of FIR filters and design appropriate filters based on the specifications.
- Realization of FIR and IIR filters in different structural forms.

Module -1	**Teaching Hours**
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution. **(Text 1 & Ref 1)**	10 Hours
Module -2	
Additional DFT properties, Application of DFT: use of DFT in linear filtering, overlap-save and overlap-add method. Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms). **(Text 1 & Ref 1)**	10 Hours
Module -3	
Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Goertzel algorithm and chirp-z transform. **(Text 2 & Ref 2)**	10 Hours
Module -4	
Structure for IIR Systems: Direct form, Cascade form, Parallel form structures. IIR filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev filters, analog to analog frequency transformations. Design of IIR Filters from analog filter using Butterworth filter: Impulse invariance, Bilinear transformation. **(Text3& Ref 3)**	10 Hours
Module -5	
FIR filter design: Magnitude and frequency response of Rectangular, Hamming, Hanning, Bartlett windows. Introduction to FIR filters, design of FIR filters using window method,Structure for FIR Systems: Direct form, Linear Phase, Frequency sampling structure, Lattice structure. **(Text3& Ref 3)**	10 Hours

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

CO1- Apply the discrete time Fourier transform algorithm and its properties on discrete time signals.
CO2- Perform linear filtering on discrete time signals using discrete time Fourier transform.
CO3- Apply the discrete in time and discrete in frequency fast Fourier transform, Chirp-Z transform, and Goertzel algorithms on discrete time signals to perform the discrete Fourier transform efficiently.
CO4- Design of infinite impulse response (IIR) filters and develop IIR structures.

CO5- Design of finite impulse response filters and develop FIR structures.
Text Books: 1. Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007. 2. Digital signal processing-Theory and Lab practice, D.Ganesh Rao, Vineeta P.Gejji, Second addition, PEARSON, 2010.
Reference Books: 1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003. 2. Digital Signal2. Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010. 3. Digital Signal Processing, Lee Tan: Elsevier publications, 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	PSO.1	PSO.2	PSO.3
CO1	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

ELECTROMAGNETIC WAVES AND ANTENNAS

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

Subject Code	21EC53	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: The objectives of the course is to enable students to:

- Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb's law and Gauss law to different charge distributions and the Laplace's and Poisson's Equations
- Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in free space, Dielectrics.
- Introduce and discuss different types of Antennas, various terminologies, excitations.
- Study different types of Arrays, Pattern-multiplication, design antennas like Yagi-Uda, Helical antennas and other broad band antennas.

Module -1	Teaching Hours
Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density. Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem. (2.1,2.2,2.4,3.1,3.2,3.5,3.6,3.7 of Text 1)	08 Hours
Module -2	
The line integral, Definition of potential difference & potential, The potential field of point charge, Potential Gradient, Current and Current density, Continuity of current, Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem (4.2,4.3,4.4,4.6,5.1,5.2,7.1,7.2,8.1,8.2,8.3,8.4 of Text 1)	08 Hours
Module -3	
Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. Farday's law, displacement current,Maxwell's equations in point form, Maxwell's equations in integral form. Wave propagation in free space, Dielectrics, Poynting's Theorem and wave power (8.5,8.6,10.1,10.2,10.3,10.4,12.1,12.2,12.3of Text1)	08 Hours
Module -4	
Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing. (2.1-2.11,2.13,2.15,5.1-5.10,5.13 of Text 2)	08 Hours
Module -5	
Antenna Types: Helical Antenna, Yagi-Uda antenna, corner reflectors, parabolic reflectors, log periodic antenna, lens antenna, antenna for special applications – sleeveantenna, turnstile antenna, omni directional antennas, antennas for satellite, antennas for ground penetrating radars, embedded antennas, ultra wide band antennas, plasma antenna. (8.1-8.3,9.3,9.9,10.115.6,15.7,15.9,15.26-15.29 of Text 2)	08 Hours

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

CO-1- Explain and analyze electric field due to point, linear, and volume charges by applying Conventional method or Gauss law.
CO-2- Analyze the potential energy of a point charge through Laplace's equation and examine laws linking magnetic fields to electric current.
CO-3- Apply Maxwell's equations for time-varying electromagnetic fields and EM wave propagation in free space, then use Poynting's theorem to calculate wave power and energy.
CO-4- Analyze the fundamentals of antenna theory.
CO-5- Understand and analyze the functionality and applications of different antennas.

Text Books:

1. W.H. Hayt and J.A. Buck, "Engineering Electromagnetics", 7th Edition, TataMcGraw-Hill, 2009, ISBN-978-0-07-061223-5.
2. D. Krauss, "Antennas and Wave Propagation", McGraw Hill TMH, 4th Edition, 2010.

Reference Books:

1. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2nd Edition 2007.
2. A.R.Harish, M.Sachidanada, "Antennas and propagation", Pearson Education, 2015.

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**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

VERILOG HDL

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

SEMESTER-V

Course Code	21EC541	CIE Marks	50
Number of Lecture Hours/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03hrs

CREDITS– 03

Course Learning Objectives:

- Learn different Verilog HDL constructs.
- Understand the basic concepts and internals of module.
- Understand different aspects of gate level design and constructs.
- Understand behavioral statements, Verilog Tasks, Functions and Directives.
- Understand the concept of logic synthesis and its impact in verification

Module 1	Teaching Hours
Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL?, trends in HDLs. **Hierarchical Modeling Concepts:** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text1: CH. 1, 2)	**08 Hours**
Module 2	
Basic Concepts: Lexical conventions, data types, system tasks, compiler directives. **Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing. (Text1: CH. 3, 4)	**08 Hours**
Module 3	
Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. **Dataflow Modeling:** Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text1: CH. 5, 6.1, 6.2, 6.3, 6.4)	**08 Hours**
Module 4	
Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements, regular delay control, event based timing control, conditional statements, Multiway branching-case statement, loops. **Tasks and functions:** differences between tasks and functions, tasks and functions with examples. (Text1: CH. 7.1-7.6, 8.1, 8.2, 8.3.1, 8.3.2)	**08 Hours**
Module 5	
Switch level modeling: switch modeling elements: MOS switches, CMOS switches, bidirectional switches, power & ground, delay specification on switches, examples. **Logic Synthesis with Verilog:** Logic synthesis, impact of logic synthesis, Verilog HDL synthesis, Synthesis design flow, verification of gate-level netlist. (Text1: CH. 11, 14.1, 14.2, 14.3, 14.4, 14.6)	**08 Hours**

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

CO-1- Emphasize the importance of Verilog HDL, design methodology, and abstraction levels in relation to a particular digital design.

CO-2- Grasp and analyze the fundamental concepts, components, and internal structure of Verilog HDL.

CO-3- Analyze and design circuits at gate level and data flow level by applying the basic knowledge of delay and operators.

CO-4- Design and explain a behavioral circuit using structured procedures and conditional statements.

CO-5- Develop fundamental switch-level circuits and analyze the various constructs used in logic synthesis.

Text Book:

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer Science+Business Media, LLC, Fifth edition.
2. Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition.
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016 or earlier.

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	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

MICROPROCESSOR 8086

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

SEMESTER-V

Course Code	21EC542	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

- Familiarize basic architecture of 8086 microprocessor
- Program 8086 Microprocessor using Assembly Level Language
- Use Macros and Procedures in 8086 Programs
- Understand interfacing of 16-bit microprocessor with memory and peripheral chips involving system design
- Understand the architecture of 8088, 8087 Coprocessor and other CPU architectures

Module -1	**Teaching Hours**
Historical back ground, Introduction to 8086, Microprocessor architecture Addressing modes, Machine language instruction. INSTRUCTION SET OF 8086:Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs	08 Hours
Module -2	
Logical Instructions, String manipulation instructions, Flag manipulation and Processor control instructions, Illustration of these instructions with example programs. Assembler Directives and Operators, Assembly Language Programming and example programs	08 Hours
Module -3	
Stack and Interrupts: Introduction to stack, Stack structure of 8086, Programming for Stack. Interrupts and Interrupt Service routines, Interrupt cycle of 8086, NMI, INTR, Interrupt programming, Timing and Delays	08 Hours
Module -4	
8086 Bus Configuration and Timings: Physical memory Organization, General Bus operation cycle, I/O addressing capability, Special processor activities, Minimum mode 8086 system and Timing diagrams, Maximum Mode 8086 system and Timing diagrams.	08 Hours
Module -5	
Basic Peripherals and their Interfacing with 8086: Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255. Timer 8254 – Mode 0 & 3 and Interfacing programmes for these modes.	08 Hours

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

CO1: Gain the knowledge of evolution of microprocessor understand and analyze architecture of 8086 its instruction sets, its configurations and timing diagrams.

CO2: Develop 8086 Assembly level programs using the 8086 instruction set

CO3: Analyze the use of various 8086 interrupts.

CO4: Investigate the 8086 operations in minimum and maximum mode using timing diagram.

CO5: Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC,

Keyboard, Display and Stepper motors.
Text Books: Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5. **Reference Books / Web links:** 1. Microprocessor and Interfacing- Douglas V Hall, SSSP Rao, 3rd edition TMH, 2012. 2. Microcomputer systems-The 8086 / 8088 Family – Y.C. Liu and A. Gibson, 2nd edition, PHI -2003. 3. The 8086 Microprocessor: Programming & Interfacing the PC – Kenneth J Ayala, CENGAGE Learning, 2011.

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	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-

OPTICAL FIBER COMMUNICATION

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

SEMESTER-V

Subject Code	21EC543	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understandthetransmissioncharacteristicsandlossesinopticalfiber.
- Study of optical components and its applications in optical communication networks.
- Learn the network standards in optical fiber and understand the network architectures along with its functionalities.

Modules	Teaching Hours
Module-1	
Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers.	**08Hours**
Module-2	
Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber. Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connectors: Cylindrical ferrule connectors, Duplex and Multiple fiber connectors, Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators.	**08Hours**
Module-3	
Optical sources: Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies. **Photo detectors**: Physical principles of Photodiodes, Photo detector noise, Detector response time. Optical Receiver: Optical Receiver Operation: Error Sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit.	**08Hours**
Module-4	
WDM Concepts and Components: Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings. **Optical amplifiers:** Basic application and Types, Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wide band Optical Amplifiers.	**08Hours**
Module-5	
Optical Amplifiers And Networks: optical amplifiers, basic applications and types,	**08Hours**

semiconductor optical amplifiers, **EDFA.** **Optical Networks:** Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.	

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

CO1-Describe the construction and working principle of optical connectors, multiplexers, amplifiers, Optical sources, and detectors.

CO2-Applications of Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, and Wide band Optical Amplifiers.

CO3-Analyze the various transmission losses in the optical fiber.

CO4-Analyzethenetworkingaspectsofopticalfiberanddescribevariousstandardsassociatedwithit.

CO5-Design and interface issues of SONET/SDH optical networks.

TextBooks:

1. GerdKeiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education (India)PrivateLimited,2015.ISBN:1-25-900687-5.
2. JohnMSenior,Optical Fiber Communications, Principles and Practice,3Edition,Pearson Education, 2010, ISBN:978-81-317-3266-3.

Reference Books:

1. Joseph C Palais, Fiber Optic Communication, Pearson Education, 2005, ISBN: 0130085103.

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

INTERNET OF THINGS

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

SEMESTER-V

Subject Code	21EC551	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Understand the overview of IoT, Physical and Logical Design of IoT.
- Studying the similarity between M2M & IoT and its system management.
- Understand IoT platform design methodology.
- Know the IoT physical devices and Python programming concept.
- Understand the role of IoT in various domains of applications.

Module -1	**Teaching Hours**
Introduction to Internet of Things **Introduction:** Definition, and Characteristics of IoT, **Physical Design of IoT**: Things in IoT, IoT Protocols **Logical Design of IoT**: IoT Functional Blocks, IoT Communication Models, IoT communication APIs **IoT Enabling Technologies:** Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems **IoT levels and Deployment Templates:** IoT level1 to Level 6 (Chapter 1)	10 Hours
Module -2	
IoT and M2M:M2M, Difference between IoT and M2M, Software defined networking and network function virtualization **IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG. (Chapter 3 & 4)	10 Hours
Module -3	
IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Purpose and Requirements Specification, Process Specification, Domain model Specification, Information Model specification, service specifications, IoT level Specifications, Functional view specifications, operational view specifications, Device and component Integration, Application Development, Motivation for Using Python(chapter-5)	10 Hours
Module -4	
IoT Systems- Logical Design using Python: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages. **IoT Physical Devices & Endpoints:** Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces. Programming Raspberry Pi with Python, Arduino, About the board.(Chapter 6&7)	10 Hours
Module -5	
Domain Specific IoTs and its Applications: Home automation, Cities, Environment Energy, Retail, logistics, Agriculture, Industry, Health and life style **IoT applications:** Smart lighting, smart parking, whether monitoring system, air	10 Hours

pollution monitoring, forest fire detection, smart irrigation. (Chapter-2 & 9)	

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

CO1- Gain a foundational understanding of IoT concepts, architecture, and analyze the data collection and processing mechanisms.

CO2- Analyze IoT communication protocols and application layer protocols, focusing on data collection, storage, and computing using cloud platforms.

CO3- Identify security concerns and analyze the vulnerabilities encountered in IoT applications.

CO4 Analyze the real-time applications of IoT in various scenarios.

CO5- Apply Python programming skills to develop IoT applications.

Text Books:

1. Arshdeep Bhaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014

Reference Book:

1. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.
2. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2.

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	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

MICROCONTROLLER AND MICROPROCESSOR

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

SEMESTER-V

Subject Code	21EC552	CIE Marks	50
Number of Lecture Hours/Week	4L	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course objectives: Students will be taught to:

- Understand the basics of microcontroller, Embedded systems and architecture of 8051microcontrollers.
- Explain and analyze the instruction sets of 8051microcontrollers and also to write the Assembly Level Programsusing8051Instructionset.
- Understand and write peripheral programming for timers, serial port and Interrupt system of 8051.
- Analyze the Application and Interfacing of 8051 Microcontroller to I/O devices.
- To develop an Understand the basics of microprocessor architecture of 8086 microprocessors.
- Analyze and write the Assembly language programs of 8086

Module -1	**Teaching Hours**
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.	**10 Hours**
Module -2	
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.	**10 Hours**
Module -3	
8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming	**10 Hours**
Module -4	
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.	**10 Hours**
Module -5	
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.	**10 Hours**

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

CO1. Understand and analyze basics of microcontroller and microprocessor.
CO2. Develop 8051 application specific programs using 8051 instruction set.
CO3. Analyze the interfacing of 8051microcontroller to various I/O devices.
CO4. Apply the 8086 instruction set to write the programs.
CO5. Investigate the performance of all the microprocessors starting from Pentium-IV to i7 and submit a report.

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.
3. Microprocessors and Interfacing, D. V. Hall, MGH, 2nd Edition 2006.

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	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

DIGITAL SIGNAL PROCESING LABORATORY

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

SEMESTER-V

Subject Code	21ECL56	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Simulate discrete time signals and verification of sampling theorem.
- Compute the DFT for a discrete signal and verification of its properties using SCILAB.
- Find solution to the difference equations and computation of convolution and correlation along with the verification of properties.
- Compute and display the filtering operations and compare with the theoretical values.
- Implement the DSP computations on DSP hardware and verify the result.

List of Experiments:

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

1. Specifications (using different window techniques). Verification of sampling theorem.
2. Linear and circular convolution of two given sequences, Commutative, distributive and associative property of convolution.
3. Auto and cross correlation of two sequences and verification of their properties.
4. Solving a given difference equation.
5. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using DFT equation and verify it by built-in routine, Study the frequency resolution with different values of N).
6.
   (i) Verification of DFT properties (like Linearity and Parseval's theorem, etc.)
   (ii) DFT computations of square pulse and sinc function etc.
7. Design and implementation of FIR filter to meet given.
8. Design and implementation of IIR filter to meet given specifications.

Following Experiments to be done using DSP kit

1.Linear convolution of two sequences
2.Circular convolution of two sequences
3.N-point DFT of a given sequence
4.Impulse response of first order and second order system
5.Implementation of FIR filter

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 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	-

ELECTROMAGNETIC WAVES AND ANTENNAS LABORATORY

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

SEMESTER-V

Subject Code	21ECL57	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Radiation pattern of antennas.
- Determining gain and directivity of a given antenna.
- Working of Klystron source.
- Study of directional coupler, Microstrip ring resonator.

List of Experiments:

1. Measurement of frequency, guidewavelength, power, VSWR and attenuation in microwave test bench
2. Measurement of directivity of microstrip dipole
3. Measurement of gainof microstrip dipole
4. Measurement of directivity of Yagi antennas.
5. Measurement of gain of Yagi antennas.
6. Measurement of directivity of horn antennas
7. Measurement of gain of horn antennas.
8. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas
9. Determination of Coupling and isolation characteristics of microstrip directional coupler.
10. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
11. Power division and isolation of microstrip power divider.
12. Measurement of cross and co-polarisation of an antenna.

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 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	-

VERILOG HDL LABORATORY

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

SEMESTER-V

Laboratory Code	21ECL581	CIE Marks	50
Number of Lecture Hours/Week	2L	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03

CREDITS – 01

Course Learning Objectives: This course will enable students to:

- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Use Verilog for a given Abstraction level.

Note: Programming can be done using any compiler. Download the programs on a FPGA/CPLD board and performance testing may be done using 32 channel pattern generator and logic analyzer apart from verification by simulation with tools such as Altera/ Model sim or equivalent.

Laboratory Experiments

PROGRAMMING

1. Write Verilog code to realize all the logic gates.
2. Write a Verilog program for the following combinational designs
    a. 2 to 4 decoder
    b. 8 to 3 (encoder without priority & with priority)
    c. Multiplexer, de-multiplexer.
3. Write a Verilog code to describe the functions of a Full Adder using three modeling styles.
4. Develop the Verilog code for 4 bit ripple carry adder.
5. Develop the Verilog code for 4 bit parallel multiplier.
6. Develop the Verilog code for the following flip-flops, SR, D, JK and T.
7. Design a 4 bit binary counters (Synchronous reset and Asynchronous reset).
8. Design 4 bit ALU and write a Verilog Code.
9. Write Verilog HDL code to control speed, direction of DC and Stepper motor.
10. Write Verilog HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.

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 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	-

MICROPROCESSOR 8086 LABORATORY

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

SEMESTER-V

Subject Code	21ECL582	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Get familiarize with 8086 instructions and DOS 21H interrupts and function calls. Develop and test assembly language programs to use instructions of 8086.
- Get familiarize with interfacing of various peripheral devices with 8086 microprocessor for simple applications.

List of Experiments:

1. **Programs involving: Data transfer instructions like**:
   i) Byte and word data transfer indifferent addressing Modes
   ii) Block move (with and without overlap)
   iii) Block interchange
2. **Programs involving: Arithmetic & logical operations like**:
   i) Addition and Subtraction of multi precisions.
   ii) Multiplication and Division of signed and unsigned Hexadecimal no,s.
   iii) ASCII adjustment instructions.
   iv) Code conversions.
3. **Programs involving: Bit manipulation instructions like checking**:
   i) Whether given data is positive or negative
   ii) Whether given data is odd or even
   iii) Logical 1‟s and 0‟s in a given data
   iv) 2 out 5code
   v) Bit wise and nibble wise palindrome.
4. **Programs involving: Loop instructions like**
   i) Arrays: addition/subtraction of N nos., Finding largest and smallest nos., Ascending and descending order.
   ii) Two application programs using Procedures and Macros (Subroutines).
5. **Programs involving**
   String manipulation like string transfer, string reversing, searching for a string.
6. **Programs involving**
   Programs to use DOS interrupt INT 21h Function calls for Reading a Character from keyboard, Buffered Keyboard input, Display of character/ String on console.

Interfacing Experiments:

Experiments on interfacing 8086 with the following interfacing modules through DIO (Digital Input/Output - PCI bus compatible card / 8086 Trainer)

1. Matrix keyboard interfacing
2. Seven segment display interface
3. Logical controller interface
4. Stepper motor interface
5. ADC and DAC Interface (8bit)
6. Light dependent resistor (LDR), Relayand Buzzer Interface to make light operated switches

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 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	-

OPTICAL FIBER COMMUNICATION LABORATORY

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

Subject Code	21ECL583	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

CourseObjectives: Thiscoursewillenablestudentsto:

1. PerformancecomparisonofopticallinkusingLEDandLASER forspecificdistance.
2. Performance Evaluation of Point to point optical link at different distances and fordifferenttransmitterpowers.
3. Performancecomparisonofopticallinkreceiversandfordifferentfibers.
4. Impactofopticalamplifiersonlinkperformance.

Experiments

1. Tostudythe VI&PIcharacteristics oftheFO-LED.
2. To studytheVI&PIcharacteristicsoftheLaserDiode.
3. RealtimeTemperaturesensor datatransferusingfiberoptic
4. Tostudythetransfer CharacteristicsbetweentheDETECTORandSOURCEwithsimplexcable.
5. TostudytheVOICEcommunicationoverthefiberopticcable.
6. TostudyVoicecommunicationusing CODEC.
7. TostudyPWMsignalcommunicationusingfiberoptic.
8. To studydigitaldata transmissionwithLEDand switch.
9. **To set up Fiber Optic Analog and fiber Optic Digital link.**
10. **Measurement of Propagation loss and numerical aperture.**
11. **Measurement of optical power bending loss in a plastic optical fiber.**
12. **Study and measure characteristics of fiber optic LED's, LDR and Laser diode.**

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.

ReferenceBooks:

1.GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,4th Edition 2010.

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-V [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	21PRJ59	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. 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 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 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**	**-**

RESEARCH ARTICLE/REPORT READING AND WRITING [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	21AEC5101	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

1. Download the research articles from the digital platforms and read it.
2. Understand the various sections of the research article.
3. How to review the literature?
1. How to formulate the research problem statement?
2. How to design the methodology, represent the result, write the research article and publish it.

EVERY WEEK STUDENTS WILL BE GIVEN ONE RESEARCH ARTICLE AND MAKE THEM TO READ UNDERSTAND AND ANALYZE IT.

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

CO-1-Independently down load the research articles of their interested domain and read it.
CO-2-Analize the various sections of the research paper and present it using power point/chart.
CO3. Do the proper literature survey and submit the report individual/ group.
CO4. Design various sections of the research paper like introduction, literature review, methodology, result and conclusions.
CO5. Write the research article and publish in indexed journals/ submit report.

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	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	-	-	-	3
CO5	-	-	-	-	-	-	-	3	3	3	-	-	-	-	3

C++ BASICS

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

Course Code	21AEC5102	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Number of Lecture Hours	24	Exam hours	03

CREDITS-01

Course Objectives: Students will be taught to:

1. Introduces object-oriented programming concepts using the C++ language.
2. Introduces the principles of data abstraction, inheritance and polymorphism;
3. Introduces the principles of virtual functions and polymorphism
4. Introduces handling formatted I/O and unformatted I/O
5. Introduces exception handling

Module -1	Teaching Hours
1. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array. 2. Write a C++ program to declare Struct. Initialize and display contents of member variables. 3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member. 4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members. 5. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary). 6. Write a C++ to illustrate the concepts of console I/O operations. 7. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels. 8. Write a C++ program to allocate memory using new operator. 9. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3) 10. Write a C++ program to create an array of pointers. Invoke functions using array objects. 11. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.	40 Hours

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 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	-

VLSI CIRCUITS

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

SEMESTER-VI

Subject Code	21EC61	CIE Marks	50
Number of Lecture Hour/Week	2L+1T	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: The objectives of the course is to enable students to:

1. Impart knowledge of MOS transistor theory and CMOS technologies
2. Impart knowledge on architectural choices and performance trade-offs involved indesigning and realizing the circuits in CMOS technology
3. Cultivate the concepts of Memory and subsystem design processes.
4. Exemplify single-stage amplifiers
5. Describe Differential amplifier and Current Mirrors.

Module -1	**Teaching Hours**
Introduction: MOS transistors, MOS Transistor Theory, Ideal I-V Characteristics, Non-Ideal I-V Effects, DC Transfer Characteristics, Fabrication Process. **(Text 1)**	08 Hours
Module -2	
MOS and BiCMOS Circuit Design Process: MOS Layers, Stick Diagrams, Design Rules and Layout, VLSI Design Flow. **(Text 3)** Sheet Resistance, Area Capacitance of Layers, Standard Unit of Capacitance, Scaling Models and Scaling factors, Scaling Factors for Device Parameters. **(Text 3)**	08 Hours
Module -3	
Memory: SRAM, DRAM, read only memory, Serial Access Memory, programmable Logic array. **(Text 1)** **Subsystem Design:** Some architectural issues, Pseudo nMOS logic, Dynamic CMOS Logic, C^2MOS logic, CMOS Domino logic**(Text 3)**	08 Hours
Module -4	
Single Stage Amplifier: Common Source Stage, Source Follower,Common gate Stage, Cascode Stage. **(Text 2)**	08 Hours
Module -5	
Differential amplifiers: Single Ended and Differential Amplifiers, Basic differential pair, Common Mode Response, Differential Pair with MOS Loads. **Passive and Active Current Mirrors:** Basic Current Mirror, Cascode Current Mirror, Active Current Mirror. **(Text 2)**	08 Hours

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

CO-1- Analyze the ideal and non-ideal I-V characteristics of MOS transistors.

CO-2- Develop the ability to create and interpret gate layouts and stick diagrams for basic circuits while adhering to design rules, and understand data path subsystems

CO-3- Design memory systems for various applications based on system requirements.

CO-4- Analyze the performance parameters of a single-stage amplifier, and design and implement a cascode amplifier

CO-5- Design and analyze a differential amplifier with MOS loads, focusing on performance improvements, and explore Current Mirrors.

Text Books:

1. "CMOS VLSI Design- A Circuits and Systems Perspective"- Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.
2. "Design Of Analog CMOS Integrated Circuits"-Behzad Razavi, McGraw Hill Education (India) Edition 2002
3. " Basic VLSI Design ", Douglass A. Pucknell & Kamran Eshraghian,PHI 3rd Edition(orginal edition 1994)2005.

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

SATELLITE COMMUNICATION

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

SEMESTER-VI

Subject Code	21EC62	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Learning Objectives: This course will enable students to

1. Understand the basic principle of satellite orbits and trajectories.
2. Study of electronic systems associated with a satellite sub system.
3. Understand the electronic system associated with earth station.
4. Understand the various technologies associated with the satellite communication.
5. Study of satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

Modules	**Teaching Hours**
Module -1	
Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization.	**08 Hours**
Module -2	
Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.	**08 Hours**
Module -3	
Earth Station: Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking.	**08 Hours**
Module -4	
Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, regional satellite Systems, National Satellite Systems.	**08 Hours**
Module-5	
Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Applications. **Weather Forecasting Satellites:** Fundamentals, Images, Orbits, Payloads Applications. **Navigation Satellites:** Development of Satellite Navigation Systems, GPS system, Applications.	**08 Hour**

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

CO-1-Illustrate the satellite orbits and its trajectories with the definitions of parameters associated with it.
CO-2-Describe the properties of electronic hardware system associated with the satellite subsystem.
CO-3-Illustrate the electronic system associated with the satellite earth station
CO-4-Analyze the applications of communication satellites with the focus on national satellite system.
CO-5-Apply the knowledge of satellite systems in various fields like remote sensing, weather forecasting and navigation.

Text Books:

1. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.

Reference Book:

Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006.

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017, ISBN: 978-81-265-0833-4

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	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

ARM CORTEX-M3 & EMBEDDED SYSTEMS

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

SEMESTER-VI

Subject Code	21EC631	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

Course Learning Objectives: This course will enable students to**:**

1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
2. Develop the hardware software co-design and firmware design approaches.
3. Explain the need of real time operating system for embedded system applications
4. Understand the architectural features and instruction set of 32 bit Microcontroller ARM Cortex M3.
5. Program ARM Cortex M3 using the various instructions and C language for different applications.

Modules	Teaching Hours
Module -1	
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation), Differences between RISC and CISC, Harvard and Von-neumann, Big and Little Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only) **(Text 1: All the Topics from Ch-1 and Ch-2 (Fig and explanation before 2.1) 2.1.1.6 to 2.1.1.8, 2.2 to 2.2.2.3, 2.3 to 2.3.2, 2.3.3.3, selected topics of 2.4.1 and 2.4.2 only).**	**08 Hours**
Module -2	
Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). **(Text 1: Ch-3, Ch-4 (4.1, 4.2.1 and 4.2.2 only), Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only))**	**08 Hours**
Module -3	
RTOS and The Embedded product development life cycle(EDLC): Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive scheduling techniques, How to choose an RTOS, The Embedded product development life cycle (EDLC): What is EDLC?,Why EDLC?, objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Text 1: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.10 only), ch-15**	**08 Hours**
Module -4	
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack	**08 Hours**

operation, reset sequence **(Text 2: Ch 1, 2, 3)**	
Module-5	
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Useful instructions, Memory mapping, Bit-band operations and CMSIS, Assembly and C language Programming **(Text 2: Ch-4(4.1,4,2,4.3.1 to 4.3.5,4,3.8,4.4only),Ch-5(5.1,5.2,5.3,5.5only), Ch-10 (10.1,10.2, 10.3, 10.4 only))**	**08 Hours**

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

CO-1-Indentify the purpose, core of embedded systems and area of applications.
CO-2- Analyze the hardware /software co-design and firmware design approaches.
CO-3- Investigate the need of real time operating system for embedded system applications.
CO-4- Analyze the architectural features of ARM Cortex M3 and apply for embedded system applications.
CO-5- Apply the knowledge gained for programming ARM Cortex M3 for applications, interface external devices and I/O with ARM microcontroller.

Text Book:

1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2nd Edition.
2. Joseph Yiu, ―The Definitive Guide to the ARM Cortex-M3‖, 2nd Edition, Newnes, (Elsevier), 2010.

Reference Book:

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0- 471-72180-2.
2. Yifeng Zhu, “Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C”, 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 2010.

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

TINY MACHINE LEARNING

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

Subject Code	21EC632	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: The objectives of the course is to enable students to:

1. Work with Arduino and ultra-low-power microcontrollers
2. Learn the essentials of ML and how to train models
3. Train models to understand audio, image, and accelerometer data
4. Explore Tensor Flow Lite for Microcontrollers, Google's toolkit for TinyML
5. Debug applications and provide safeguards for privacy and security

Module -1	**Teaching Hours**
Getting up to speed on ML: What machine learning actually is, Deep learning workflow, decide on a goal, collect dataset, design model architecture, train the model, convert model, run interface, Evaluate and troubleshoot, wrapping up, Machine learning tool chain, Python and Jupyter notebooks, Google co laboratory, tensor flow and keras building model, importing dependencies, generating data, splitting data, defining basic model, Training model, training metrics, graphing the history, improving model, testing, converting model to tensor flowlite, converting to C file. **Hello world of TinyML: Building an application**, walking through tests, including the dependencies, setting up test, getting ready to log data, mapping model, creating allopsresolver, defining tensor arena, creating interpreter, inspecting input, running interface, reading output, running tests, project file structure, walking through source. **Hello world of TinyML: Deploying to Microcontrollers,** Arduino, sparkfun edge, ST Microelectronics, handling output, running example, making own changes. (Chapter 3, 4, 5 & 6 of Text1)	08 Hours
Module -2	
Wake-word detection: Building an application, application architecture, introducing model , all moving parts, walking through the tests, basicflow, audio provider, feature provider, command recognizer, command responder, listening for wake words, running application, deploying to microcontrollers. **Wake-word detection: Training a Model**, Training in co lab, using model, replacing model, updating labels, updating command responder, other ways to run scripts, model working, visualizing inputs, understanding model architecture, model output, training data, speech commands dataset, training dataset, data augmentation, model architectures. **Person detection: Building an application**, application architecture, introducing model, all moving parts, walking through the tests, basic flow, image provider, detection responder, detecting people, deploying to microcontrollers, wrapping up**.** **Person detection: Training model,** picking a machine, setting google cloud platform instance, training framework choice, building dataset, training model, tensorboard, evaluating model, exporting to tensorflow lite, training other categories, understanding architecture. (Chapter, 7, 8 9 & 10, of Text1)	08 Hours
Module -3	

Magic Wand: Building an application, application architecture, introducing model, all moving parts, walking through the tests, basic flow, accelerometer handler, gesture predictor, output handler, detecting gestures, deploying to microcontrollers. **Magic Wand: Training model**, training in Colab, other ways to run the scripts, model working, visualizing input, understanding model architecture, training data, capturing data, modifying training scripts, using new model. **TensorFlow lite for Microcontrollers**, tensorflow, tensorflow lite, tensorflow lite for microcontrollers, requirements, model interpretation, project generation, building systems, specializing code, makefiles, writing tests, supporting a new hardware platform, supporting a new IDE, integrating code changes, contributing back to open source, supporting new hardware accelerators, understanding file format, porting tensorflow lite mobile Ops to micro. **Designing own TinyML applications**, design process, need a microcontroller or larger device, understanding possibilities, find similar models to train, look data, wizard of Oz-ing, get it working on desktop. (Chapter 11, 12, 13 & 14 of Text1)	10 Hours
Module -4	
Optimizing Latency, first make sure it matters, hardware changes, model improvements.quantization, product design, code optimizations, optimizing operations, contributing back to opensource. **Optimizing energy usage,** developing intuition, typical component power usage, hardware choice, measuring real power usage, estimating power usage for model, improving power usage for model, duty cycling, cascading design. **Optimizing model and binary size,** understanding system's limits, estimating memory usage, flash usage, RAM usage, ballpark figures for model accuracy and size on different problems, model choice, reducing size of executables, truly tiny models. (Chapter 15, 16 & 17 of Text1	10 Hours
Module -5	
Debugging, accuracy loss between training and deployment, preprocessing differences, debugging preprocessing, On-device evaluation, Numerical differences, are the differences problem, establish a metric, compare against baseline, swap out implementation, mysterious crashes and hangs, desktop debugging, log tracing, shotgun debugging, memory corruption, **Porting models from tensor flow to tensorflow lite,** understand Ops need, look existing Op coverage in tensorf low lite, move preprocessing and postprocessing into application code, implement and optimize Ops, **Privacy, security and deployment,** privacy design document, using a PDD, protecting models, moving from a development board to a product (Chapter 18, 19 & 20 of Text1)	10 Hours
Course Outcomes: After studying this course, students will be able to: CO-1-Make use concepts in Tiny ML. CO-2-Build an application and deploy to the microcontroller CO-3-Analyze a Tensor flow lite for microcontroller and Design a Tiny ML application. CO-4- Experiment with Latency, Energy usage, model and binary size parameter. CO-5- Analyze accuracy loss between training and deployment, Privacy, security and deployment	
Text Books: 3. Pete warden and Daniel Situnayake, TinyML: Machine Learning with TensorFlow Lite on Arduino and UltraLow-Power Microcontrollers, O'Reilly Media, 1st edition, 2020. ISBN-10: 1492052043.	

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

PROGRAMMING USING PYTHON

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

SEMESTER – VI

Subject Code	21EC633	IA Marks	50
Number of Lecture Hours/Week	3L	Exam Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

1. Learn Syntax and Semantics and create Functions in Python.
2. Handle Strings and Files in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Implement Object Oriented Programming concepts in Python
5. Build Web Services and introduction to Network and Database Programming inPython.

Module – 1	TeachingHours
The way of the program, Variables, expressions and statements, Functions, conditionals and recursions	8 Hours
Module – 2	
Iteration, Strings, lists	8 Hours
Module – 3	
Dictionaries, Tuples, Files, Regular Expressions	8 Hours
Module – 4	
Classes and objects, Classes and functions, Classes and methods	8 Hours
Module – 5	
Networked programs, Using Web Services, Using databases and SQL	8 Hours

Course outcomes: The students should be able to:

CO1- Understand Python syntax and semantics, and be fluent in the use of Python flow control and Functions.
CO2- Develop, run, and manipulate Python programs using Core data structures like Lists, Dictionaries, and string handling methods.
CO3- Develop, run, and manipulate Python programs using File Operations and searching patterns using regular expressions.
CO4- Interpret the concepts of object-oriented programming using Python.
CO5- Implement exemplary applications related to Network Programming, Web Services, and Databases in Python.

Text Books:

1.Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition,GreenTeaPress,2015.(http://greenteapress.com/thinkpython2/thinkpython2.pdf)(Chapters 1-3,5,7,8,10-12,14-17) (Download pdf files from the above links)
2.Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 11 –13, 15)

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition,Pearson Education India, 2015. ISBN-13: 978-9332555365

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

IOT TECHNOLOGY

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

SEMESTER-VI

Subject Code	21EC634	CIE Marks	50
Number 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:

1. Understand an overview of IoT, M2M communication and design principles.
2. Understand the internet connectivity principles, protocols, data collection, storage and the concept of cloud computing.
3. Know about IoT Privacy, Security and Vulnerabilities Solutions.
4. Understand the role of IoT in various domains of applications.
5. Understand the IoT physical devices and Python programming concept.

Module -1	**Teaching Hours**
Introduction to Internet of Things: Definition, and Characteristics of IoT **Physical Design of IoT:** Things in IoT, IoT Protocols **Logical Design of IoT:** IoT Functional Blocks, IoT Communication Models, IoT communication APIs **IoT Enabling Technologies:** Wireless sensor networks, Cloud computing, Big data analytics, communication protocol, Embedded systems **IoT levels and Deployment Templates:** IoT level1 to Level 6 (Chapter 1 from Textbook -1)	08 Hours
Module -2	
IoT and M2M: M2M, Difference between IoT and M2M, Software defined networking and network function virtualization **IoT System Management with NETCONF-YANG:** Need for IoT System Management, SNMP, Network operator requirements, NETCONF, YANG, IoT System Management with NETCONF-YANG. (Chapter 3 & 4 from Textbook 1)	08 Hours
Module -3	
Design Principles for Web Connectivity: Web Communication Protocols for Connected Devices, Message Communication Protocols for connected devices. (Chapter 3 from Textbook 2) **Internet Connectivity Principles**: Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Application Layer Protocols: HTTP, HTTPS, FTP. (Chapter 4 from Textbook 2)	08 Hours
Module -4	
Data Collection, Storage and Computing Using a Cloud Platform: Introduction, Cloud Computing Paradigm for Data Collection, Storage and Computing. Everything as a Service and Cloud Service Models. IoT Cloud-Based Services Using the Xively, Nimbits. (Chapter 6 from Textbook 2) **IoT Privacy, Security and Vulnerabilities:** Introduction, Vulnerabilities, Security Requirements and Threat Analysis, (Chapter 10 from Textbook 2)	08 Hours
Module -5	
IoT Systems- Logical Design using Python: Introduction, Installing Python, Python	

Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Python Packages of Interest for IoT. **IoT Physical Devices & Endpoints:** Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces. Programming Raspberry Pi with Python, Arduino, About the board. (Chapter 6&7 from Textbook 1)	08 Hours

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

CO-1- Gain a foundational understanding of IoT concepts, architecture, and analyze the data collection an1d processing mechanisms.
CO-2- Analyze IoT communication protocols and application layer protocols, focusing on data collection, storage, and computing using cloud platforms.
CO-3- Identify security concerns and analyze the vulnerabilities encountered in IoT applications.
CO-4 Analyze the real-time applications of IoT in various scenarios.
CO-5- Apply Python programming skills to develop IoT applications.

Text Books:

1. Raj Kamal, "Internet of Things- Architecture and Design Principles", McGraw Hill Education.
2. Qusay F. Hassan, Internet of Things A to Z Technologies and Applications, IEEE press, WILEY, ISBN:978-1-111-945674-2.
3. Arshdeep Bahaga and Vijay Madisetti, "Internet of Things – A Hands-on Approach 2014.

Reference Book:

1. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.
2. Peter Waher, Learning Internet of Things, Packet Publishing Limited, Jan 2015.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

CONTROL SYSTEM

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

SEMESTER-VI

Subject Code	21EC641	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:

1. To introduce the components and their representation of control systems
2. Learn how to find a mathematical model of electrical, mechanical and electromechanical systems.
3. Find the transfer function via Mason's rule.
4. Know how to find time response and analyze the stability of a system from the transfer function.
5. To learn various methods for analyzing the time response, frequency response and stability of the systems

Module -1	Teaching Hours
INTRODUCTION TO CONTROL SYSTEMS: Basic control system and its classifications, Servomechanics, Differential Equation Of Physical Systems: Mechanical Systems, Electrical Systems, Analogous Systems (mentioned system numerical's) (Text1& Ref 1)	**08 Hours**
Module -2	
MODELING A CONTROL SYSTEM: Transfer functions, Block diagram algebra and Signal Flow graphs.	**08 Hours**
Module -3	
TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS: Standard test signals, Unit step & ramp step response of First order Systems , Unit step response of second order System, Time response specifications of second order systems, steady state errors and error constants. (Text1& Ref 1)	**08 Hours**
Module -4	
STABILITY ANALYSIS AND ROOT LOCUS: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Introduction to Root Locus Techniques , The root locus concepts, Construction of root loci.(Text1& Ref 1)	**08 Hours**
Module -5	
FREQUENCY DOMAIN ANALYSIS AND STABILITY: Correlation between time and frequency response, Bode Plots, Nyquist Stability criterion (Text1 & Ref 1)	**08 Hours**

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

CO-1- Derive and analyze Mechanical and Electrical Systems using analogous system.

CO-2- Analyze the transfer functions of block diagram algebra, and signal flow graphs for system analysis.

CO-3- Analyze the time response specification and evaluate steady state errors and error constants for different types of input signals.

CO-4- Develop root locus diagrams and analyze the system dynamics for stability assessment.

CO-5- Assess the stability of control systems in frequency domain using the Nyquist and Bode plots.

Text Books:

1. J.Nagarath and M.Gopal, ― Control Systems Engineering‖, New Age International (P) Limited,

Publishers, Fifth edition-2005, ISBN: 81-224-2008-7.
Reference Books: 1. Control Systems,‖ A Anand Kumar ,Second Edition. 2. Modern Control Engineering,‖ K.Ogata, Pearson Education Asia/PHI, 4th Edition, 2002. ISBN 978-81-203-4010-7.

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	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-

SMART AGRICULTURE

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

Subject Code	21EC642	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to

1. Focus on sustainable soil and land management for climate-smart agriculture.
2. It provides technical knowledge and examines how wide-scale implementation of climate-smart soil and land management practices can enhance mitigation of climate change and adaptation to its impacts.
3. Understanding concept of various sensors used for agriculture
4. Understanding communication standards used to collect the data from sensor
5. Learn how to Monitor the plant health

Modules	Teaching Hours
Module -1	
Soil Science: Nature and origin of soil; soil minerals, classification and composition, soil reaction, soil properties including structure, PH, surface tension and soil nutrient	**8 Hours**
Module -2	
Sensors: Classification and characteristics, Smart sensors, Colorimetry based detection, MEMS Electrochemical Sensors, Dielectric Soil Moisture Sensors, ISFET, Weather sensors, Proximity Sensors, Signal conditioning and converters..	**8 Hours**
Module -3	
Actuators for tool automation: A.C.-D.C. Motors, Stepper motor, Solenoid actuators, Piezoelectric motors, Electric drives, Hydraulic and Pneumatic actuator	**8 Hours**
Module -4	
Telemetry: Wireless communication modules and topology, Zig-bee, Bluetooth, LORA, Zero power devices, Energy Harvesting technology	**8 Hours**
Module-5	
Plant health monitoring: Measurement of leaf health, chlorophyll detection, ripeness level, crop mapping, fertilizing, Drone technology for soil field analysis and assistive operations. **Technologies for farming:** Water quality monitoring, micro-irrigation system, solar pump and lighting system, Fencing, Android based automation, Agricultural Robots, Standards for agriculture	**8 Hours**

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

CO-1-Describe the Soil science, Objectives, and Importance of Soil.
CO2-Apply Concepts of Sensors and Smart sensors for measuring soil parameters.
CO-3- Apply concepts of Actuators for tool automation.
CO-4- Make use of wireless communication technologies for Telemetry prototypes for measuring soil quality
CO-5-apply drone technology and android-based automation, agricultural robots in Agriculture

Text Books:

1. The nature and properties of Soils: Eurasia Publishing House Pvt Ltd, New Delhi Brady, Nyle C. (1988).
2. Measurement Systems; Application and Design: Doeblin, D.O. McGraw Hill, 1984.

Reference Books:

1. Smart Agriculture: An Approach towards Better Agriculture Management: Editor: Prof. Dr. Aqeel-ur-Rehman, OMICS Group,
2. Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS,
3. optical MEMS, and microfluidic systems: Ville Kaajakari, Small Gear Publishing Principles of Industrial Instrumentation: Patranabis. D, Tata McGraw Hill, 1995.
4. Mechatronics: Bolton, W. 2004.Pearson Education Asia
5. Photo-voltaic energy systems: Design and Installation: Buresch, Mathew. 1983 McGraw-Hill Book Company, New York.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

CRYPTOGRAPHY AND NETWORK SECURITY

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

Course Code	21EC643	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students will be taught to:

1. Explain the objectives of information security.
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability.
3. Understand various cryptographic algorithms.
4. Apply methods for authentication, access control, intrusion detection and prevention.
5. Indentify and mitigate software security vulnerabilities in existing systems

Module -1	**Teaching Hours**
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security **Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	08 Hours
Module -2	
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm	08 Hours
Module -3	
Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), **Message authentication codes:** Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.	08 Hours
Module -4	
Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure. **Transport-level Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)	08 Hours
Module -5	
Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security	08 Hours
Course Outcomes: After studying this course, students will be able to: CO-1-Apply the various cryptography techniques for data encryption and decryption. CO-2-Apply and analyze various symmetric and asymmetric key ciphering techniques.	

CO-3-Generate public authentication codes and distribute. CO-4-Implementation of transport layer security. CO-5- Implementation of wireless mobile security.	
Text Books: 1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition. 2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.	

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	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

INTRODUCTION TO UAV ELECTRONICS

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

Course Code	21EC651	CIE Marks	50
Number of Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: Students will be taught to:

1. To introduce the basic concepts of comparator, converter and interfacing circuits.
2. To give exposure on the construction and working of digital circuits.
3. To get introduce about the basics of signal generators.
4. To make familiarize with the microprocessor and its applications.
5. To make familiarize with the microprocessor and its applications.

Module -1	**Teaching Hours**
Linear Ic's: OP-AMP specifications, applications, voltage comparator, A/D and D/A converter, sample and hold circuit, timer, VCO, PLL, interfacing circuits.	10 Hours
Module -2	
Digital Systems**:** Review of TTL, ECL, CMOS- Logic gates, Flip Flops, Shift Register, Counter, Multiplexer, Demultiplexer / Decoder, Encoder, Adder, Arithmetic functions, analysis and design of clocked sequential circuits, Asynchronous sequential circuits.	10 Hours
Module -3	
Signal Generators: Monostable, Astable and Bistable muti-vibrators. Schmitt Trigger. Conditions for oscillation, RC phase shift oscillator, Wien bridge oscillator, Crystal oscillator. LC oscillators. Relaxation oscillators.	10 Hours
Module -4	
Microprocessor Based Systems:The 8085 microprocessor, interfacing with Alpha numeric displays, LCD panels, Stepper motor controller, Analog interfacing and industrial control.	10 Hours
Module -5	
Microcontroller Based Systems: 8031/8051 Micro controllers:– Architecture- Assembly language Programming-Timer and Counter Programming- External Memory interfacing – D/A and A/D conversions – Multiple Interrupts . Introduction to 16 bit Microcontrollers.	10 Hours

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

CO1:Understand and apply the basic concepts of Electronic Systems for UAV.

CO2: Get exposure in the construction and analyze the working of digital circuits.

CO3: Understand,analyze and design various signal generators used in the avionics.

CO4: Get familiarize with microprocessors/ microcontrollers and will be able to deploy these skills effectively in designing avionics subsystems.

CO5: Conduct independent study and investigations on microprocessors/ microcontrollers based designs.

Text Books:

1. Jacob Millman, Christos C Halkias, SatyabrataJit, Millman's, “Electronic Devices and Circuits”, Second Edition, Tata McGraw Hill,New Delhi, 2007.
2. Donald P Leach, Albert Paul Malvino, GoutamSaha, “Digital Principles and Applications”, 6th Edition Tata McGraw Hill, New Delhi, 2006.
3. Gayakwad, Ramakant A., “Op-Amps And Linear Integrated Circuits”, Prentice Hall/ Pearson Higher Education, New Delhi, 1999.

Reference Books / Web links:

1. John Crisp, “Inroduction to Microprocessor and Microcontroller”, Newnes Publication, London. 2004.
2. William Kleitz, “Microprocessor and Microcontroller Fundamentals: The 8085 and 8051 Hardware and Software”, Prentice Hall Inc, New York, 1997.

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	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

INTRODUCTION TO DRONE TECHNOLOGY

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

SEMESTER-VI

Course Code	21EC652	CIE Marks	50
Number of Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: Students will be taught:

1. To understand the basic concepts of UAV drone systems.
2. To introduction to Design of UAV drone system.
3. To stability and control of an aircraft.
4. To UAV drone integration/ installation/ configuration.
5. To various navigation methods and tools.

Module -1	Teaching Hours
Introduction to Drones: Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, applications, DGCA regulations.	10 Hours
Module -2	
Design of UAV Drone Systems: Basic principles of flight mechanics, Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Design Standards and Regulatory Aspects-India Specific, Design for Stealth.	10 Hours
Module -3	
Avionics Hardware of Drones: Flight control board, Autopilot, AGL-pressure sensors servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration.	10 Hours
Module -4	
Communication, Payload and Control Dispensable and Non-Dispensable payloads – Control of HTOL, VTOL, Control of Payloads and Sensors - Communication media, Radio communication, Factors affecting drone flight performance and efficiency.	10 Hours
Module -5	
Navigation and Testing: GPS, Waypoints navigation, ground control software, System Ground Testing, System In-flight Testing, Future Prospects and Challenges.	10 Hours

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

CO1: Understand the classification and analyze the system composition of UAV
CO2: Design UAV Drone systems with different Characteristics/Configurations.
CO3: Integrate, install and configure the UAV.
CO4: Analyze the controls of HTOL/VTOL and payloads/sensors.
CO5: Navigate and test the UAV system.

Text Books:

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
4. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998 5. Dr.

Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics.

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	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-

EMBEDDED SYSTEMS

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

Course Code	21EC653	CIE Marks	50
Number of Lecture Hours/Week	4L	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03hrs

CREDITS– 04

Course Learning Objectives: This course will enable students to**:**

1. Understand the basic hardware components and their selection method based of the characteristics and attributes of an embedded system.
2. Understand typical Embedded system with its components.
3. Develop the hardware software co-design and firmware design approaches.
4. Explain the need of real time operating system for embedded system applications
5. Understand the integration, testing of Embedded hardware and firmware and Embedded development Life cycle.

Module 1	**Teaching Hours**
Introduction To Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded system, characteristics of embedded systems and quality attributes of an embedded system, Embedded system-Application specific and Domain specific. **(Text 1:Chapter-1,chapter-3 and chapter-4)**	**10Hrs**
Module 2	
Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, Onboard communication interfaces, External communication interfaces, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer. **(Text 1:Chapter-2)**	**10 Hrs**
Module 3	
Hardware Software Co-Design and Program Modeling: Fundamental issues in hardware software co-design and Computational models in Embedded design. **Embedded Firmware Design And Development:** Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development. **(Text1:Chapter 7.1,7.2,chapter 9.1 and 9.2)**	**10 Hrs**
Module 4	
RTOS Based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques and How to choose an RTOS	**10 Hrs**

(**Text1: Chapter 10)**	
Module 5	
Integration and testing of Embedded hardware and firmware. **Embedded system Development Environment** – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques. **The Embedded product development life cycle (EDLC):** What is EDLC? Why EDLC? objectives of EDLC, Different phases of EDLC,EDLC approaches(Modeling the EDLC) **(Chapter 12,13,15)**	**10 Hrs**

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

CO-1-Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems and its applications

CO-2-Apply the knowledge of Microcontrollers to understand the basics of typical embedded system and its design components.

CO-3-Analyze the typical embedded system components.

CO-4-Develop the hardware /software co-design and firmware design approaches.

CO-5-Investigate the process of embedded product development life cycle.

Text Book:

1. Shibu K V, ―Introduction to Embedded Systems‖, Tata McGraw Hill Education Private Limited, 2nd Edition.

Reference Books:

1. James K. Peckol, "Embedded systems- A contemporary design tool", John Wiley, 2008, ISBN: 978-0- 471-72180-2.
2. Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", 2nd E -Man Press LLC ©2015 ISBN:0982692633 9780982692639.
3. Embedded real time systems by K.V. K. K Prasad, Dreamtech publications, 2003.
4. Embedded Systems by Rajkamal, 2nd Edition, McGraw hill Publications, 2010

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

VLSI CIRCUITS LABORATORY

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

SEMESTER-VI

Subject Code	21ECL66	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
- Learn DRC, LVS and Parasitic Extraction of the various designs.
- Design and simulate the various basic CMOS analog circuits and use them in higher circuits like data converters using design abstraction concepts.
- Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.

List of Experiments:

Following Experiments to be done using MATLAB / SCILAB / OCTAVE or equivalent:

PART A

ASIC DIGITAL DESIGN

1. Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given constraints*. Do the initial timing verification with gate level simulation.
   i. CMOS flip flop
   ii. Transmission Gate
   iii. Edge triggered D Flip flop
   iv. 4 bit Ripple Carry Adder, Carry Look Ahead Adder
   v. Serial Adder
   vi. 32 bit ALU
   vii. Ripple Counter using T- Flop Flop
   viii. 4-bit counter [Synchronous and Asynchronous counter]

PART B

ANALOG DESIGN

1. Design an Inverter with given specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC
   c. Check for LVS
   d. Extract RC and back annotate the same and verify the Design
   e. Verify & Optimize for Time, Power and Area to the given constraint*
2. Design the (i) Common source and Common Drain amplifier and
   (ii) A Single Stage differential amplifier, with give specifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis

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 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	-

EMBEDDED SYSTEM LABORATORY

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

SEMESTER-VI

Subject Code	21ECL671	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
2. Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
3. Interface external devices and I/O with ARM Cortex M3.
4. Develop C language programs and library functions for embedded system applications.

List of Experiments:

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

1. Display ―Hello World‖ message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7. Demonstrate the use of an external interrupt to toggle an LED On/Off.
8. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9. Interface a simple Switch and display its status through Relay, Buzzer and LED.
10. Measure Ambient temperature using a sensor and SPI ADC IC.

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 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	-

MACHINE LEARNING LABORATORY

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

SEMESTER-VI

Subject Code	21ECL672	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Understand the Integrated development environments and deploying the code to specific microcontrollers
2. Analyse the code written in platforms like C, C++, Python, Tensor flow, Google's Colab
3. Understand microcontrollers like Arduino Nano, Sparkfun Edge and ST Microelectronics STM32F746G discovery kit for various applications
4. Design Tiny ML applications
5. Design model architecture, train, convert, run interface evaluate and troubleshoot

List of Experiments:

1. Build an application and deploy it to a microcontroller for turning LEDs on and off
2. Build an application for wake word detection and deploy it to a microcontroller
3. Build an application for person detection and deploy it to a microcontroller
4. Build an application for Magic Wand and deploy it to a microcontroller
5. For a given model optimize latency
6. Estimate, measure and improve the power usage for a model
7. Optimize the given model in terms of its binary size
8. Port a model from tensorflow to tensorflow lite

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 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	-

PROGRAMMING USING PYTHON LABORATORY

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

SEMESTER-VI

Subject Code	21ECL673	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Learn Syntax and Semantics and create Functions in Python.
2. Handle Strings and Files in Python.
3. Understand Lists, Dictionaries and Regular expressions in Python.
4. Implement Object Oriented Programming concepts in Python
5. Build Web Services and introduction to Network and Database Programming inPython.

List of Experiments:

1.write a program to demonstrate different number data types in python(script.py)

2. Create a list and perform the following methods
   1) insert() 2) remove() 3) append() 4) len() 5) pop() 6)clear()

3.write a program to perform different arithmetic operations on numbers in Python.

4.write a program to demonstrate working with tuples in python.

5.write a program to create, concatenate and print a string and accessing sub-string from given string

6. Create a dictionary and apply the following methods
   1) Print the dictionary items 2) access items 3) useget() 4)change values 5) use len()

7. Write a python program to find largest number among three numbers.

8. Write a python program to check whether the given string is palindrome or not.

9. Program to convert temperature in Celsius to Fahrenheit

10.write a python program to construct the following pattern, using a nested for loop

11.write a python script that prints prime numbers less than 20

12.write a python program to find the factorial of a number using recursion

13.Write a program to do the following operations:
   i. Create a empty dictionary with dict() method
   ii. Add elements one at a time
   iii. Update existing key‟s value
   iv. Access an element using a key and also get() method
   v. Deleting a key value using del() method

14. Write a program to create a dictionary and apply the following methods:
   i. pop() method
   ii. popitem() method
   iii. clear() method

15. Given a dictionary, write a program to find the sum of all items in the dictionary.

16. Write a program to merge two dictionaries using update() method.

17.write a program that input a text file .the program should print all of the unique words in the file in alphabetical order.

18.write a python class to convert an integer to Roman numeral.

19.write a python class to implement pow(x, n).

20.write a python class to reverse a string word by word.

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 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	-

IOT TECHNOLOGY LABORATORY

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

SEMESTER-VI

Subject Code	21ECL674	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Understand the use of Respberry Pi.
2. Study the Interfacing of Gas, Soil Moisture, Ultrasonic sensor, Temperature sensor, and Humidity sensor to the Respiberry Pi.
3. Understand the use of Things speaks or xtrans cloud storage.
4. Study the design of IoT application.

List of Experiments:

Following Experiments to be done using Python Application software

PART-A

1) Getting started with raspberry Pi 3B+- down loading OS, connecting to PC monitor and initial setup.
2) Study of various sensors- i) GAS Sensor ii) Soil Moisture Sensor iii) Light Sensor iv) Ultrasonic Distance Sensor v) Temperature and Humidity Sensor.
3) Interfacing GAS sensor to the Respberry pi and test the working of GAS sensor and make the buzzer on.
4) Interfacing Soil moisture sensor to the Respberry pi and test the working of soil moisture sensor and send the data to cloud.
5) Interfacing light sensor to the Respberry pi and test the working of light sensor and send the data to cloud.
6) Interfacing Ultrasonic distance to the Respberry pi and test the working of ultrasonic distance senor.
7) Interfacing Temperature & Humidity sensor to the Respberry pi and test the working of Temperature & Humidity sensor.

PART-B

1) Live weather broadcasting using DHT11 and Things speak cloud/xtrans cloud.
2) Smart gas leakage email alerts using Things speak or xtrans alerts.
3) Weather display system using DHT11 and LCD display.
4) Object distance display using 7-segment display and Ultrasonic sensor.
5) Read the sensor data when specified key is pressed.

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 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-VI [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VI			
Subject Code	21PRJ68	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
4. 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 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 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**	**-**

PROFESSIONAL ETHICS

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

Subject Code	21HSM69	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives:

1. To enable the students to create an awareness on Engineering Ethics and Human Values,
2. To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Module -1	**Teaching Hours**
HUMAN VALUES Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management	04 Hours
Module -2	
ENGINEERING ETHICS Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories	04 Hours
Module -3	
ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	04 Hours
Module -4	
SAFETY, RESPONSIBILITIES AND RIGHTS Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination	04 Hours
Module -5	
GLOBAL ISSUES Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility	04 Hours

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

CO-1-Understand the human values required to live peaceful in the society.

CO-2-Apply ethics in society, discuss the ethical issues related to engineering

CO-3-Realize the responsibilities and rights of an engineer in the society
CO-4-Understand the role and responsibility of an engineer in maintaining the safety of society.
CO-5-Understand the global issues related to product development.

Text Books:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

Reference Books:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, " Value Education", Vethathiri publications, Erode, 2011

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

ANTENNAS DESIGN SIMULATION

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

Subject Code	21EC6101	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Students will be able to understand the working principle of different antennas
2. Students will be able to microstrip antennas using 3DEM of Mentorgraphics.
3. Students will be able to understand the different feeding techniques
4. Students will be able to design, Microstrip antennas for various wireless applications

List of Experiments:

1. Design and simulation of rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness
2. Design of microstrip patch antenna using microstrip line feeding technique
3. Design of microstrip patch antenna using a coaxial feeding technique
4. Design and simulation of dual-band patch antenna
5. Design and simulation of compact patch antenna
6. Design and simulation of wide band patch antenna
7. Design and simulation of compact and wide band patch antenna
8. Design and simulation of circular polarized patch antenna

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.

Text book:

1. C A Balanis, Antenna Theory: Analysis and Design, John Wiley & Sons, 2nd. Edn.

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	-

DESIGN OF VLSI CIRCUIT USING LT SPICE

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

SEMESTER-IV

Subject Code	21EC6102	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. To provide practical exposure on designing, setting up, executing and debugging various electronic circuits.
2. Draw the schematic diagram some digital circuits like few combinational and sequential circuits and verify their functionality.
3. Draw the schematic diagram some analog circuits and verify their functionality.
4. Use open source simulation software to analyze the circuits.

List of Experiments:

Design Analyze and simulate using LT-SPICE

1. Inverter
2. NAND Gate
3. NOR Gate
4. 2:1 MUX
5. RS-Flip flop
6. D-Flip flop
7. T- Flip flop
8. Half adder
9. Common source with resistive load
10. Ring oscillator

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 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	-

COMPUTER NETWORKS

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

SEMESTER-VII

Subject Code	21EC71	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2. Understand the protocols associated with each layer.
3. Learn the different networking architectures and their representations.
4. Learn the various routing techniques and the transport layer services.

Modules	**Teaching Hours**
Module -1	
Introduction: Data Communications: Components, Representations, Data Flow. **Networks**: Physical Structures, Network Types: LAN, WAN, Switching, The Internet. **Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Text 1: 1.1,1.2,1.3,2.1,2.2,2.3.	**08 Hours**
Module -2	
Data-Link Layer: Introduction: Nodes and Links, Services, Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. **Data Link Control (DLC)**: services, Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. **Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing, Channelization. Text 1: 9.1,9.2,11.1,11.2,12.1,12.2,12.3.	**08 Hours**
Module -3	
Connecting Devices: Hubs, Switches, Routers. **Virtual LANs:** Membership, Configuration, Communication between Switches and Routers, Advantages. **Network Layer:** Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Forwarding of IP Packets: Based on destination Address and Label. Text 1: 17.1, 17.2,18.1,18.2,18.4,18.5	**08 Hours**
Module -4	
Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging tools, ICMP checksum. Mobile IP: Addressing, Agents, Three Phases,	**08 Hours**

Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing, Unicast Routing Protocol: Internet Structure, Routing Information Protocol, Open Shortest Path First, Border Gateway Protocol Version 4. Text 1: 19.1,19.2,19.3, 20.1,20.2,20.3	
Module-5	
Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, **Transport Layer Protocols:** Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol, **User Datagram Protocol**: User Datagram, UDP Services, UDP Applications, **Transmission Control Protocol:** TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control. Text 1: 23.1, 23.2,24.1, 24.2, 24.3	**08 Hours**
Course Outcomes: At the end of the course, the students will be able to: CO-1- Demonstrate the fundamental principles of computer networking and the significance of layered network architecture in facilitating communication. CO-2- Identify and analyze the protocols and services associated with the Data Link layer in networking. CO-3- Describe the protocols and functions of the Network layer and their impact on data transmission and routing. CO-4- Analyze and design routing protocols, and evaluate the packet routing process using various routing algorithms. CO-5- Recognize the protocols and services of the Transport layer, and explain their role in supporting communication processes across the network.	
Text Books: 1. Data Communications and Networking ,Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-3	
Reference Books: 1. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896-4 2. Introduction to Data Communication and Networking, WayarlesTomasi, Pearson Education, 2007, ISBN:0130138282	

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

MOBILE COMMUNICATION AND NETWORKS

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

SEMESTER-VII

Subject Code	21EC72	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40 Hours	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Understand the wireless fundamentals.
2. Understand the various generations of cellular technologies.
3. Understand the concepts of modulation techniques and multiple access schemes.
4. Understand the multicarrier modulation.
5. Understand the concepts of multiple antenna transmission and reception.

Module -1	**Teaching Hours**
Wireless Fundamentals: Communication system building blocks, The broadband wireless channel: Path loss and shadowing, Cellular systems, The broadband wireless channel: Fading, Modelling of broadband fading channels, Mitigation of narrowband fading, Mitigation of broadband fading. (**Text1: 2.1-2.4, 2.5.1-2.5.2, 2.6.2-2.6.5, 2.7.1-2.7.2**)	**08 Hours**
Module -2	
Evolution of cellular technologies: Introduction, Evolution of mobile broadband, The case for LTE/SAE, Key enabling technologies and features of LTE, LTE network architecture, Spectrum options and migration plans for LTE, Future of mobile broadband-Beyond LTE. (**Text1: 1.1-1.8)**	**08 Hours**
Module -3	
Modulation and multiple access schemes: Binary phase shift keying (BPSK), Quadrature phase shift keying (QPSK), M-ary quadrature amplitude modulation (QAM), Multiple access techniques: Introduction, Frequency division multiple access (FDMA), Time division multiple access (TDMA), Spread spectrum multiple access, Space division multiple access (SDMA). (**Text2: 6.8.1, 6.8.3, 6.8.4, 6.10.2, 9.1-9.5)**	**08 Hours**
Module -4	
Multicarrier modulation: The Multicarrier concept, OFDM basics, OFDM in LTE, Timing and frequency synchronization, The peak-to-average ratio, Single-carrier frequency domain equalization (SC-FDE), The computational complexity advantage of OFDM and SC-FDE. (**Text1: 3.1-3.7)**	**08 Hours**
Module -5	
Multiple antenna transmission and reception: Spatial diversity overview, Receive diversity, Transmit diversity, Spatial multiplexing, How to choose between diversity, Interference suppression and spatial multiplexing, Channel estimation and feedback for MIMO and MIMO-OFDM. (**Text1: 5.1-5.3, 5.5-5.7**)	**08 Hours**

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

CO-1-Understand cellular concepts and signal propagation in mobile communication
CO-2- Explain the evolution of cellular technologies.
CO-3-Analyze the modulation and multiple access schemes.
CO-4-Apply the multicarrier modulation techniques for advanced wireless communication systems design.
CO-5-Analyze the multiple antenna transmission and reception techniques.

Text Books:

1. Arunabha Ghosh, Jun Zhang, Jeffrey G. Andrews, Rias Muhammed, "Fundamentals of LTE", Pearson Education, 2018.
2. T.S.Rappaport, "Wireless Communications Principles and Practice", PHI, 2nd Edition, 2010.

Reference Books:

1. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. HarriHolma and Antti Toskala, "LTE for UMTS Evolution to LTE-Advanced', John Wiley & Sons, 2nd Edition , 2011.
3. Vijay K. Garg, J.E.Wilkes, "Principle and Applications of GSM", Pearson Education, 2006.

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	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

DIGITAL IMAGE PROCESSING

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

SEMESTER- VII

Course Code	21EC73	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam hours	03

CREDITS-03

Course Objectives: Students will be taught to:

1. Understand the fundamentals of digital image processing
2. Understand the image enhancement techniques in spatial domain used in digital image processing
3. Understand the frequency domain enhancement techniques in digital image processing
4. Understand the Color Image Processing in digital image processing.
5. Understand the image restoration techniques and methods used in digital image processing

Module -1	**Teaching Hours**
Whatis Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. **(Text: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2)**	08 Hours
Module -2	
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters [Text 1: Chapter 3: Sections 3.2 to 3.6]	08 Hours
Module -3	
Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. [Text 1: Chapter 4: Sections 4.7 to 4.9]	08 Hours
Module -4	
Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing. [Text 1: Chapter 6: Sections 6.1 to 6.3] Error(Wiener) Filtering, Constrained Least Squares Filtering. (Text: Chapter 5: Sections 5.2, to 5.9)	08 Hours
Module -5	
Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering. [Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8] Teaching Learning Process Chalk and talk method, PowerPoint P????	08 Hours

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

CO1. Ability to define the fundamental concepts of digital image processing and to recognize

different image processing applications.
CO2. Ability to apply image processing techniques in both the spatial domain.
CO3. Study and analysis of image enhancement in frequency domain.
CO4. Investigate the various noise models and image restoration techniques.
CO5. Ability to learn color image processing and morphological image processing.

Text Books:

1.Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Refrence Books:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014.
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.

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**	**-**	**-**
CO2	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

POWER ELECTRONICS

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

SEMESTER-VII

Subject Code	21EC741	CIE Marks	50
Number Lecture Hour/Week	3L	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives The objectives of the course is to enable students to:

1. Understand the working of various power devices.
2. Study and analysis of thyristor circuits with different triggering techniques.
3. Learn the applications of power devices in controlled rectifiers, converters and inverters.
4. Study of power electronics circuits under different load conditions.

Modules-1	**Teaching Hours**
Introduction & Power Transistors: Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics. (Text 1)	**08 Hours**
Module -2	
Thyristors : - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation . Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firingcircuit.(Text 2)	**08 Hours**
Module -3	
Controlled Rectifiers & AC Voltage Controllers : Controlled Rectifiers - Introduction, principle of phase controlled converter operation, Single phase full converters, Single phase dual converters. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase control with resistive and inductive loads. (Text 1)	**08 Hours**
Module -4	
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classifications. (Text 1)	**08 Hours**
Module-5	
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter. (Text 1)	**08 Hours**

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

CO-1- Analyze the I-V characteristics of SCR, DIAC and TRIAC.

CO-2- Analyze the characteristics of MOSFET, IGBT and UJT.

CO-3- Construct and demonstrate the operation of AC voltage controller and differentiate its various

configurations.
CO-4- Design controllers for dc-dc converters in voltage and peak-current mode
CO-5- Apply the different modulation techniques to pulse width modulated inverters and identify the harmonic reduction methods.

Text Books :

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897.

Reference Books :

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.

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**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO4	**3**	**3**	**3**	**-**	**-**	**-**	2	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO5	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

LOW POWER VLSI DESIGN

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

Subject Code	21EC742	CIE Marks	50
Number 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:

1. Know the basics and advanced techniques in low power design which is a hot topic in today's market where the power plays a major role.
2. Describe the various power reduction and the power estimation methods.
3. Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system.
4. Apply State-of-the art approaches to power estimation and reduction.
5. Practice the low power techniques using current generation design style and process technology

Modules	**Teaching Hours**
Module -1	
Introduction: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS leakage current, static current, basic principles of low power design, low power figure of merits.	08 Hours
Module -2	
Simulation Power Analysis: SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.	08Hours
Module -3	
Probabilistic Power Analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.	08 Hours
Module -4	
Circuit: Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage.	08 Hours
Module -5	
Logic: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic (Text 1). **Architecture and System :** Power and Performance Management,Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation.	08 Hours

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

CO-1-Identify and analyze the various sources of power dissipation in CMOS circuits.

CO-2-Analysis of power for discrete, gate level and architecture level using SPICE simulation.

CO-3- Analysis of probabilistic power techniques and power estimation using signal entropy.

CO-4-Design and optimize circuit networks by applying restructuring and reorganization techniques to meet low-power objectives.

CO-5-Apply strategies to minimize switching activity for improved energy efficiency and design gate reorganization techniques to boost circuit efficiency and lower power consumption.

Text Book:

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic, 1998.

Reference Books:

1. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000
2. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, “ Low power VLSI CMOS circuit design”, Kluwer Academic,1995.
3. Jan M.Rabaey, MassoudPedram, “Low Power Design Methodologies” Kluwer Academic, 2010.

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	2	3	-	-	-	-	2	-	-	-	-	-	3	-	-
CO3	2	3	2	-	-	-	2	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-
CO5	2	3	3	-	-	-	2	-	-	-	-	-	3	-	-

DSP ALGORITHMS AND ARCHITECTURE

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

SEMESTER-VII

Subject Code	21EC743	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Figure out the knowledge and concepts of digital signal processing techniques.
2. Understand the computational building blocks of DSP processors and its speed issues.
3. Understand the various addressing modes, peripherals, interrupts and
4. Pipelining structure of TMS320C54xx processor.
5. Learn how to interface the external devices to TMS320C54xx processor in Various modes.

Modules	Teaching Hours
Module -1	
Architectures for Programmable Digital Signal – Processing Devices: Introduction, Basic Architectural Features, Classic DSP architecture characteristics, On-chip memories, DSP Computational Building Blocks, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing, Speed Issues.	**08 Hours**
Module -2	
TMS320C54xx Architecture: Introduction, Architectural overview ofTMS320C54xx DSP, Central Processing Unit, Internal Memory Organization, Program Control, Detail study of TMS320C54x& 54xx instructions and programming: Arithmetic operations, logical operations, program control operations, load and store operations.	**08 Hours**
Module -3	
Implementation of Basic DSP Algorithms: Introduction, Number representation in DSP, FIR filters, IIR filters, Interpolation and Decimation Filters (One example in each case) **Implementation of FFT Algorithms:** Introduction, DFT & IDFT, Requirement of FFT algorithms, Computation involved in Butterfly implementation, Algorithm for DIT-FFT implementation	**08 Hours**
Module -4	
Memory and Parallel I/O in TMS320C54xx-Description and Interfacing: Introduction, Memory Space, Program Memory, Dual access memory and the pipeline, single access memory and the pipeline, Data memory, External Bus, External memory Interfacing, External memory signal generated by 54xx, Memory Address decoding, Interfacing Parallel and I/O Devices.	**08 Hours**
Module-5	
Interfacing and Applications of DSP Processors: Introduction, DSP based measurement system, Heart rate monitor, Speech Processing System	**08 Hours**

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

CO-1- Outline and describe DSP fundamentals, DSP architecture, Address Generation Units (AGU), DSP computational blocks and on-chip memory.

CO-2- Comprehend architecture of TMS320C54XX DSP, Instructions sets and Assembly language

programming.
CO-3- Analyze and design various filters, number representation and FFT algorithms.
CO-4- Perceive the various memory devices and I/O interfacing.
CO-5- Gain insight into DSP measurement and speech processing systems, and develop heart rate monitors.

Text Books:

1. "Digital Signal Processors" AndhePallavi and K.Uma Rao, Pearson-Education, 2012.

Reference Books:

1. "Digital Signal Processing: A practical approach", Ifeachor E. C., Jervis B. W Pearson-Education, PHI, 2002.
2. "Digital Signal Processors", B Venkataramani and M Bhaskar, TMH, 2nd, 2010
3. "Architectures for Digital Signal Processing", Peter Pirsch John Weily, 2008
4. "Digital Signal Processing", Avatar Singh and S. Srinivasan, Thomson Learning, 2004.

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	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-

E-WASTE MANAGEMENT

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

SEMESTER-VII

Subject Code	21EC751	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

1. This course covers an extensive review of e-waste management in India.
2. Focus on the evolution of legal frameworks in India and the world, it presents impacts and outcomes; challenges and opportunities; and management strategies and practices to deal with e-waste.
3. Pan-India initiatives and trajectories of law-driven initiatives for effective E-waste management along with responses from industries and producers.
4. Mitigate E-waste management issues, and helps to generate employment.
5. Start E-waste recycling plants, with this the demand for employees with all levels of qualification and skills also increases.

Module -1	**Teaching Hours**
Introduction to Waste Management Waste – Definition, Different types of Waste – Biodegradable, non – biodegradable, plastic waste, biomedical waste, E- waste, Construction and demolition waste and Industrial waste, Scope of waste management audits, significance and benefits of conducting waste management audits.	10 Hours
Module -2	
Audit Procedure and preparation ,E-Waste management audit procedures and target areas of auditing, Benefits, phases and components of ewaste management audit, e-waste risk assessment, composition and impact of e-waste in environment, Role of education institution in e-waste generation, qualitative and quantitative measures to conduct audits, carbon emission due to e –waste, Report preparation.	10 Hours
Module -3	
Toxicity and Health hazards of E waste: Introduction, Burden of E waste, Health hazard, Electronic waste Managemnt, E waste Cycling Taking on circular economy, Impact of Spent Lithium -Ion Batteries Recycling on Economy and Environment: Introduction, Structure of Lithium-Ion Battery, Multiple ways for final disposal of Batteries, Phases of recycling process, Challenges in recycling of Lithium -Ion batteries, Recycling process Lithium -Ion batteries.	10 Hours
Module -4	
Disposal techniques and its impact,impact of E- Waste on Health and environment, Impact of Recycling E-Waste, Availability of more resources in recycling, Essentials for E-Waste Disposal audit, Essential disposal steps for these e-waste items, Steps for Mobile Device Disposal, Personalized Recommendations for EWaste Disposal, Action Plan and Suggestions for Waste Reduction in the Organization .	10 Hours

Module -5	
Laws and Legislation: Broad overview of e-waste management policies in the U.S, e-waste management rules in India, UNEP, GeSI – Global e-sustainability initiative, E-waste treatment system and Technology.	10 Hours

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

CO-1: Comprehend e-waste management, global and Indian statistics, regulatory frameworks, and sustainability concepts such as SDGs, Circular Economy (CE), and Life Cycle Impact Assessment (LCIA).

CO-2: Understand & explain Extended Producer Responsibility (EPR) as a regulatory framework for e-waste management, its implementation across different countries, and its impact on human health and the environment.

CO-3: Evaluate themes related to resource use, sustainable development, urban mining, financial support for recycling infrastructure, and policy needs for resource utilization in India.

CO-4: Identify and analyze pan-India initiatives, including research, legal frameworks, industrial interventions, and strategies for achieving the Agenda 2030 goals.

CO-5: Assess the opportunities and challenges in four key domains: legal and judicial frameworks, economic aspects, recycling culture/society, and environmental concerns.

Reference Books:

1. VarshaBhagatGangulay, 'E-Waste Management', Taylor and Francis, 2022.
2. https://link.springer.com/book/10.1007/978-3-030-14184-4 3.
3. https://rajyasabha.nic.in/rsnew/publication_electronic/E-Waste_in_india.pdf
4. https://greene.gov.in/wp-content/uploads/2018/01/E-waste-Vol-II-E-waste-Management-
5. Manual.pdf •https://nptel.ac.in/courses/105105169

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

WIRELSESS SENSOR NETWORKS [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VII			
Subject Code	21EC752	CIE Marks	50
Number Lecture Hour/Week	4L	SEE Marks	50
Number of Lecture Hours	48	Exam Hours	03
CREDITS-04			

Course Objectives: This course will enable students to:

1. Architect sensor networks for various application setups.
2. Explore the design space and conduct trade-off analysis between performance and resources.
3. Devise appropriate data dissemination protocols and model links cost.
4. Determine suitable medium access protocols and radio hardware.
5. Applications of wireless sensor networks in commercial components.

Modules	**Teaching Hours**
Module -1	
Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. **RBT:L1, L2**	10 Hours
Module -2	
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies.**RBT:L1, L2**	10 Hours
Module -3	
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **RBT:L1, L2,L3**	10 Hours
Module -4	
Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. **RBT:L1, L2,L3**	08 Hours
Module -5	
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. **RBT:L1, L2**	10 Hours

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

CO-1- Explore the technology and apply the principles of Wireless Sensor Networks across various domains.

CO-2-Develop applications of wireless sensor actuator networks.
CO-3-Analyze various routing protocols for wireless sensor networks.
CO-4- Analyze various design issues in wireless sensor networks.
CO-5-Apply the WSN in applications like, building automation, industrial automation, medical applications, military applications, etc.

Text Book:

1. 1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:, WILEY , Second Edition (Indian) , 2014.
2. 2.Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
3. 3.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

Reference Books:

1. .K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 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	PSO.1	PSO.2	PSO.3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-

ROBOTICS

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

Subject Code	21EC753	CIE Marks	50
Number of Lecture Hour/Week	4L	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

1. Demonstrate an ability to apply spatial transformation to obtain forward kinematics equation of robot manipulators.
2. Demonstrate an ability to perform kinematics and inverse kinematics analysis of robot systems.
3. Demonstrate knowledge of robot controllers.
4. To develop the student's knowledge in various robot structures and their workspace.

Modules	**Teaching Hours**
Module -1	
INTRODUCTION ROBOTICS: Robotics – Basic components – Classification – Performance characteristics – Actuators- Electric actuator- DC motor horse power calculation, magneto-astrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors – Tactile sensors – Proximity and range sensors - ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems – Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.	**10 Hours**
Module -2	
ROBOT CONTROL : Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control-variable structure control- Impedance control.	**10 Hours**
Module -3	
END EFFECTORS: End effectors and tools- types – Mechanical grippers – Vacuum cups – Magnetic grippers – Robot end effectors interface, work space analysis work envelope-workspace fixtures-pick and place operation- continuous path motion-interpolated motion-straight line motion.	**10Hours**
Module -4	
ROBOT MOTION ANALYSIS : Robot motion analysis and control: Manipulator kinematics -forward and inverse kinematics	**10 Hours**
Module-5	
ROBOT APPLICATIONS : Industrial and non industrialrobots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear plants.	**10 Hours**

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

CO1: Understand and apply the significance, social impact and future prospects of robotics and automation in various engineering applications.

CO2: Identify and describe the anatomy of robotic system and analyze robotic motions.

CO3: Summarize drives, end-effectors and identify DOF for different robot applications

CO4: Classify about sensors and various path planning techniques and design different robotic motions

CO5: Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios.

Text Books:

1. Mikell P Grover et. al. "Industrial Robots: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 1980, ISBN 9781259006210.
2. Robert J. Schilling, "Fundamentals of Robotics-Analysis and Control", PHI Learning, 2009, ISBN 9788120310476

Reference Books:

1. K.S. Fu, Ralph Gonzalez, C.S.G. Lee, "Robotics: control, sensing, vision and Intelligence", 1st Edition, Tata Mcgraw-Hill, 2008, ISBN 9780070265103

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	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

COMPUTER NETWORKS LABORATORY

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

SEMESTER-VII

Subject Code	21ECL76	CIE Marks	50
Number Lab practice Hour/Week	2P	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
2. Design a suitable network and simulate using a Network simulator tool.
3. Simulate the networking concepts and protocols using C/C++ programming.
4. Model the networks for different configurations and analyze the results.

Laboratory Experiments

PART-A:
Implement the following in C/C++

1. Write a program for a HLDC frame to perform the Bit stuffing.
2. Write a program for a HLDC frame to perform the Character stuffing.
3. Write a program for Distance vector algorithm to find suitable path for transmission.
4. Implement Dijkstra's algorithm to compute the shortest routing path.
5. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
   a. Without error
   b. With error
6. Implementation of Stop and Wait Protocol.
7. Implementation of Sliding Window Protocol.
8. Write a program for congestion control using leaky bucket algorithm.

PART-B:
Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3.
Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
4. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
5. Implementation of Link state routing algorithm.

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.

Reference Book

1. Data Communications and Networking ,Forouzan, 5th Edition, McGraw Hill, 2016 ISBN: 1-25-906475-3.
2. Computer Networks, James J Kurose, Keith W Ross, Pearson Education, 2013, ISBN: 0-273-76896

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 IMAGE PROCESSING LABORATORY

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

SEMESTER-VII

Course Code	21ECL77	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
Number of Lecture Hours	24	Credits	03

CREDITS-01

Course Objectives: Students will be taught to:

1. To introduce the concepts of image processing.
2. To expose students to basic concepts such as distance and connectivity, image transformation, point operation, analysis of colour image processing.
3. To introduce the concepts of Image Compression techniques.
4. To expose students to basic edge detection techniques.

LIST OF EXPERIMENTS

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

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 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	-

POWER ELECTRONICS LABORATORY

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

Subject Code	21ECL781	CIE Marks	50
Number Lecture Hour/Week	02	SEE Marks	50
Number of Practical Hours	24	Exam Hours	03

CREDITS-01

Any five experiments from the below list **must be** simulated using the **spice-simulator**.

Course objectives: This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of:

1. SCR, DIAC Static characteristics
2. Static characteristicsof MOSFET and IGBT
3. Controlled Rectifiers
4. SCR Turn off &UJT firing circuit circuits.
5. Voltage (Impulse) commutated choppers.
6. AC voltage controllers & controlled rectifiers.
7. Speed control of universal & stepper motor.

Experiments

1. Static characteristics of SCR and DIAC.
2. Static characteristics of MOSFET and IGBT
3. Controlled HWR and FWR using RC triggering circuit
4. SCR turn off using
   a. LC circuit
   b. ii) Auxiliary Commutation
5. UJT firing circuit for HWR and FWR circuits.
6. Generation of firing signals for thyristors/ trials using digital circuits/ microprocessor.
7. AC voltage controller using triac – diac combination.
8. Single phase Fully Controlled Bridge Converter with R and R-L loads.
9. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
10. Speed control of universal motor.
11. Speed control of stepper motor.

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.

Text Books :

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th

Edition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc- Graw Hill, 2009, ISBN: 0070583897.

Reference Books :

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.

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	-

LOW POWER VLSI DESIGN LABORATORY

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

SEMESTER-VII

Subject Code	21ECL782	CIE Marks	50
Number Lab practiceHour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Understand the different parameters which are going to effect on power.
2. Understand the different types of power dissipations.
3. Learn different types of low power VLSI designs techniques.
4. Learn the use of different EDA tools.
5. Understand the design and realization of CMOS Digital circuits.

Laboratory Experiments

Following Experiments to be done using Mentor Graphics/Cadence Tool/ Spice Tool

Design, simulate and estimate the power dissipation for following circuits using

a) Conventional CMOS techniques.

1. Inverter
2. NAND and NOR
3. XOR/ XNOR

b) MTCMOS techniques.

4. D-Latch
5. NAND and NOR
6. XOR/ XNOR

c) DTCMOS techniques.

7. Inverter

d) compare static NOR and dynamic NOR

e) Glitch free AND circuit.

f) D-latch using clock gating.

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.

Reference Book

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic, 1998.
2. Kaushik Roy, Sharat Prasad, “Low-Power CMOS VLSI Circuit Design” Wiley, 2000
3. A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer Academic,1995. 3. A Bellamour and M I Elmasri, “ Low power VLSI CMOS circuit design”, Kluwer Academic,1995.
4. Jan M.Rabaey, MassoudPedram, “Low Power Design Methodologies” Kluwer Academic, 2010.
5. Sung-Mo Kang and Yusuf Leblebici “CMOS Digital Integrated Circuits”

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	-

DSP ALGORITHM AND ARCHITECTURE LABORATORY

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

SEMESTER-VII

Subject Code	21ECL783	CIE Marks	50
Number Lab practiceHour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Use of instruction set of TMS320C54xx DSP processor to develop ALP for DSP algorithms.
2. Learn ALP programming for TMS320C54xx
3. Learn the use of Code Composer Studio (CCS) IDE software.
4. Understand the design and realization of Digital FIR and IIR filter
5. Understand the design and realization of Decimation and Interpolation filters

Laboratory Experiments

Following Experiments to be done using Code Composer Studio (CCS) IDE and DSP Processor

1. Write a TMS320C54XX assembly language program to add set of 5 numbers stored in an array labeled 'num'
2. Write a TMS320C54XX assembly language program to compute the dot product of two vectors x1 and x2 and store the product in the location y.
3. Write a TMS320C54XX assembly language program to compute the output y=mx1+C. consider that x1 and C are stored in data memory and m in the program memory. The result y should be stored in data memory. Assume suitable values of m, x1 and C.
4. Write a TMS320C54xx assembly language program to read 100 words from input port address INPORT and store them in the data memory at address 'Buffer'.
5. Write a TMS320C54xx assembly language program to implement y(n)=h0 X x(n)+h1 X x (n-1)+h2 X x(n-2).
6. Write the assembly language program to multiply two Q15 numbers Num1 and Num2 and obtain the result N3.
7. Write an assembly language program to implement IIR filter
8. Write an assembly language program to implement FIR filter
9. Write an assembly language program to implement Decimation filter
10. Write an assembly language program to implement interpolation filter

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.

Reference Book

1. AndhePallavi, K.Uma Rao, Digital Signal Processor Architecture, Programming and Applications, Pearson Education ISBN-978-81-317-6666-8.

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-VII [As per NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VII			
Subject Code	21PRJ79	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

1. Get exposure about the electronics hardware and various software tools.
2. Design the working model of the open ended problem.
3. Understand concepts of Packaging.
1. Understand the latest technology trends in the PCB design.
2. 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 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**	**-**

INDUSTRIAL PSYCHOLOGY AND ORGANISATIONAL BEHAVIOUR

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

SEMESTER-VII

Subject Code	21HSM710	CIE Marks	50
Number of Lecture Hour/Week	1L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

1. Relating human psychology to science
2. Understand the human psychology
3. Understand the nature of organization and organization models
4. Understand the human social communication
5. Understand the leadership qualities

Modules	**Teaching Hours**
Module -1	
Introduction to I/O psychology: Major fields of I/O psychology, brief history of I/O psychology, employment of I/O psychology, ethics in I/O psychology. (Chapter-1)	**3 Hours**
Module -2	
Organisational communication: Types of organizational communication, interpersonal communication, improving employee communication skills. (Chapter-11)	**3 Hours**
Module -3	
Leadership : Introduction, personal characteristics associated with leadership, interaction between the leadership and the situation specific leader skills, leadership where we are today. (Chapter-12)	**5 Hours**
Module -4	
Group behaviour- teams and conflicts Group dynamics, factors affecting group performance, individual versus group performance, group conflicts. (Chapter-13)	**5 Hours**
Module-5	
Stress management: Dealing with the demands of life and work, stress defined, predisposition to stress, sources of stress, consequences of stress, stress reduction intervention related to life /work issues. (Chapter-15)	**4 Hours**

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

CO-1-Comprehend the knowledge and concepts of human psychology

CO-2-know the importance of communication in organization.

CO-3-have insight into individual, group behavior and leadership skills.

CO-4-deal with people in better way by knowing their behavior.

CO-5-Dealing with stressand work issues.

Text Book: Michael G.Aamodt, Industrial/Organizational Psychology: An Applied Approach, 6th

Edition, Wadsworth Cengage Learning, ISBN: 978-0-495-60106-7.

Reference Books:
1. Blum M.L. Naylor J.C., Horper& Row, Industrial Psychology, CBS Publisher, 1968
2. Luthans, Organizational Behaviour, McGraw Hill, International, 1997
3. Morgan C.t.,KingR.A.,JohnRweisz&John Schoples, Introduction to Psychology, McHraw Hill, 1966
4. SchermerhornJ.R.Jr., Hunt J.G &Osborn R.N., Managing, Organizational Behaviour, John Willy

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

RESEARCH PROJECT/FIELD PROJECT-VIII [As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VIII			
Subject Code	21PRJ81	CIE Marks	50
Total No. of implementation weeks	16P	SEE Marks	50
		Exam Hours	03
CREDITS-8			
Course Objectives: Students will be Guided to: 1. Understanding about the Project and its components. 2. Introduction of the project selected. 3. Detailed literature survey of the project and understand concepts of problem identification. 4. Design and development of Proposed Methodology. 5. Implementation of the proposed methodology and thesis document preparation.			
STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM INDIVIDUALLY			
Course outcomes: After studying this course, students will be able to: CO-1- 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. CO-3-Design and development of proposed methodology based on the societal needs, environmental friendly. CO-4-Use the modern tool available like advanced hardware and software tools to implement the proposed methodology and make it use for society and prepare a document and submit. CO-5-Publish the proposed work in the peer reviewed Journal			

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

INTERNSHIP [As per Outcome Based Education (OBE) and Choice Based Credit System (CBCS) Scheme] SEMESTER-VIII			
Subject Code	21ECI82	CIE Marks	50
Total No. of implementation/training weeks	12P	SEE Marks	50
		Exam Hours	03

CREDITS-06

Course Objectives: Students will be taught to:

1. Learn to appreciate work and its function in the economy.
2. Develop work habits and attitudes necessary for job success.
3. Develop communication, interpersonal and other critical skills in the job interview process.
4. Build a record of work experience.
5. Acquire employment contacts leading directly to a full-time job following graduation from college.

Students has to carry out the internship OF 12 weeks in the industry.

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