Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2018-19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018-19)

Programme: B.Tech: Electronics and Communication Engineering

III SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BS	18MAT31	Engineering Mathematics-III	Mathematics	4			3	50	50	100	04
2	HCC	18EC32	Analog Circuits		3	1		3	50	50	100	04
3	HCC	18EC33	Digital System Design		3	1		3	50	50	100	04
4	HCC	18EC34	Network Analysis		3	1		3	50	50	100	04
5	HCC	18ECL35	Analog Circuits Lab				2	3	50	50	100	01
6	HCC	18ECL36	Digital System Design Lab				2	3	50	50	100	01
7	HCC	18ECL37	Network Analysis Lab				2	3	50	50	100	01
8	PW	18PRJ38	Project-3				2	3	50	50	100	01
9	HSS	18KANKK310 /20KANAK310	Kannada Kali-III/ Ayda Kategalu	Humanities	1			2	50	50	100	01
Total					**14**	**3**	**08**	**26**	**450**	**450**	**900**	**21**

Note: BS-Basic Science, HCC-Hard Core Course, PW-Project Work, HSS-Humanity and Social Science, NCMC-Non Credit Mandatory Course

18KANKK310 Kannada Kali-III is for non Kannada speaking, reading and writing students and 20KANAK310 Ayda Kategalu is for the students who speak,

read and write Kannada.

Project(PRJ): Based on the ability /abilities of the student/s and recommendations of the mentor, a single discipline or multidisciplinary mini project can be assigned to an individual students or to a group having not more than 4 students.

Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP31	Additional Mathematics – I	Mathematics	3	1	-	3	00	100	100	00

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

Courses prescribed to lateral entry B.Sc. degree holders admitted to III semester of Engineering programs

Lateral entry students from B.Sc. stream, shall clear the non credit courses Computer Aided Engineering Drawing, Elements of Civil Engineering of First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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

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

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

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

Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2018-19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018-19)

Programme: B.Tech: Electronics and Communication Engineering

IV SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BS	18MAT41	Engineering Mathematics-IV	Mathematics	4			3	50	50	100	04
2	HCC	18EC42	Analog and Digital Communication		3	1		3	50	50	100	04
3	HCC	18EC43	Microcontroller		3	1		3	50	50	100	04
4	HCC	18EC44	Signals and Systems		3	1		3	50	50	100	04
5	HCC	18ECL45	Analog and Digital Communication Lab				2	3	50	50	100	01
6	HCC	18ECL46	Microcontroller Lab				2	3	50	50	100	01
7	HCC	18ECL47	Signals and Systems Lab				2	3	50	50	100	01
8	PW	18PRJ48	Project-4				2	3	50	50	100	01
9	HSS	18KANKK410 /20KANMD410	Kannada Kali-IV/ Mahadasohigalu	Humanities	1			2	50	50	100	01
Total					**14**	**3**	**08**	**26**	**450**	**450**	**900**	**21**

Note: BS-Basic Science, HCC-Hard Core Course, PW-Project Work, HSS-Humanity and Social Science, NCMC-Non Credit Mandatory Course

18KANKK410 Kannada Kali-IV is for non Kannada speaking, reading and writing students and 20KANMD410 Mahadasohigalu is for the students who speak,

read and write Kannada.

Project(PRJ): Based on the ability /abilities of the student/s and recommendations of the mentor, a single discipline or multidisciplinary mini project can be assigned to an individual students or to a group having not more than 4 students.

Courses prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics – II	Mathematics	3	1	-	3	00	100	100	00

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

Courses prescribed to lateral entry B.Sc. degree holders admitted to III semester of Engineering programs

Lateral entry students from B.Sc. stream, shall clear the non credit courses Computer Aided Engineering Drawing, Elements of Civil Engineering of First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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

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

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

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

ENGINEERING MATHEMATICS-III

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

SEMESTER-III

Subject Code	18MAT31	CIE Marks	50
Number of 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:

- Introduce most commonly used analytical and numerical methods in the different engineering Fields.
- Learn Laplace transform and Z-transforms, statistical methods, numerical methods.
- Solve the problem on Interpolation.
- To discuss the random variable and associated probability distributions.

Module -1	**Teaching Hours**
LAPLACE TRANSFORMS: Definition Transforms of Elementary functions, properties of 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). **RBT: L1,L2**	10 Hours
Module -2	
Z-TRANSFORMS: Difference Equations, Basic definitions, Damping rule, Shifting rule, Initial and Final Value theorems (without proof) and problems. Inverse Z-transforms. Applications of Z-transforms to solve difference equation (5 Assignment Problem). **RBT: L1,L2**	10 Hours
Module -3	
STATISTICAL METHODS: Correlation-karl Pearson's co-efficient of correlation problems. Regression analysis lines of regression (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). **RBT: L1,L2**	10 Hours
Module -4	
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$(\frac{1}{3})^{rd}$, $(\frac{3}{8})^{th}$ rules, Weddle's rule (without proof) problems. (5 Assignment Problem). **RBT: L1,L2**	10 Hours
Module -5	
Probability Distribution: Random variables (discrete and continuous) probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and Normal distributions. Problems. (5 Assignment Problem). **RBT: L1,L2**	10 Hours

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

- Know the use of Laplace transform and inverse Laplace transform in signal and image

Processing.

- Explain the general linear system theory for continuous Time signals and digital signal processing using the Z-transform.
- Employ appropriate numerical methods to solve algebraic and transcendental equations.
- Apply Green's Theorem, Divergence Theorem and Stokes theorem in various applicatio n in the field of electro-magnetic and gravitational fields and fluid flow problems.

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., 2015.

Reference Books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand Publishing, 1st edition, 2011.

ANALOG CIRCUITS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	18EC32	CIE Marks	50

Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Number of Lecture Hours	50	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

- Understand the operation of various diode clipping and clamping circuits.
- Understand the operation and design of zener regulator.
- Understand the operation and analyze the various bias circuits of BJT & FET.
- Analyze the amplifier circuits using BJT & JFET.
- Understand the operation of various feedback topologies and design the Oscillator circuits.
- Understand and analyze the different power amplifier circuits.
- Understand the basic concepts of operational amplifier and its various applications.

Module -1	**Teaching Hours**
Diode circuits and applications: DC load line, Clippers, Clampers, Zener diode as voltage regulator. **BJT Biasing:** Introduction, Operating point, Fixed bias configuration, Voltage divider bias configuration, Emitter bias configuration, Transistor switching networks, Bias stabilization. **RBT: L1,L2,L3**	10 Hours
Module -2	
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. **Field effect transistors:** Introduction, Construction and Characteristics of JFETs, Transfer characteristics, Depletion type MOSFET, Enhancement type MOSFET. **JFET biasing:** Fixed bias configuration, Self bias configuration, Voltage divider bias configuration. **JFET small signal model**: Introduction, Fixed bias configuration, Voltage divider configuration. **RBT: L1,L2,L3**	10 Hours
Module -3	
BJT frequency response: Introduction**,** Logarithms, Decibels, General frequency considerations, Low frequency response-BJT amplifier, Miller effect capacitance, High frequency response-BJT amplifier. **Feedback and Oscillator circuits:** Feedback concepts, Feedback connection types, Oscillator operation, Phase shift oscillator, Tuned Oscillator Circuit, Crystal oscillator (BJT versions only). **Power amplifiers:** Introduction-Definitions and amplifier types, Series fed class A amplifier, Transformer coupled Class A amplifier, Class B amplifier operation, Complementary symmetry circuits, Amplifier distortion, Class C and class D amplifiers **RBT: L1,L2,L3**	10 Hours
Module -4	
Operational amplifier parameters and performance: Basic Op-Amp internal circuitry, Input, output & supply voltages, Offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. **Op-Amps as DC amplifiers:** Biasing Op-Amps, Direct coupled voltage follower, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers and Difference amplifier, Instrumentation amplifier. **Op-Amp applications:** Zero Crossing detector**,** Inverting Schmitt trigger circuit, Differentiating Circuit, Integrator Circuit, Precision rectifiers. **Active Filters:** First order and Second order active Low-pass and High pass filters,	10 Hours

Band-pass filters and Notch filters. **RBT: L1,L2,L3**	
Module -5	
Voltage Regulator: Introduction, Series Op-Amp regulator, IC voltage regulators, 723 general purpose regulators. **555 timers**: Introduction, Description of functional diagram, Monostable operation and Astable operation. **Phase locked loop:** Basic Principles, Phase detector/comparator, Voltage Controlled Oscillator (VCO). **D-A and A-D converters**: Introduction, Weighted resistor DAC, R-2R ladder DAC, ADC using Successive approximation. **RBT: L1,L2,L3**	10 Hours

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

- Construct diode Clippers, Clampers and Zener diode voltage regulator.
- Apply DC & AC analysis of BJT & JFET in circuit designing.
- Analyze and design the Oscillator circuits and Power amplifiers.
- Analyze and design the linear and non-linear applications using Op-Amp.
- Design Voltage regulators and Data converters.

Text Books:

1. Robert L. Boylestad and Louis Nashelsky, "Electronics Devices and Circuit Theory", Pearson, 10th Edition, 2012, ISBN: 978-81-317-6459-6.
2. David A. Bell, "Operational Amplifiers and Linear ICs", Oxford University Press, 3rd Edition, 2011.
3. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition, 2010, ISBN 978-81-224-3098-1.

Reference Books:

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.
2. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw-Hill Education, 2nd Edition, 2007.
3. Ramakant A Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4th Edition, 2015.

DIGITAL SYSTEM DESIGN [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	18EC33	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:

- Illustrate simplification of Algebraic equations using Karnaugh Maps Technique.
- Design combinational logic circuits, Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators.
- Describe Latches and Flip-flops, Registers and Counters.
- Develop state diagrams for Synchronous Sequential Circuits.
- Analyze Mealy and Moore Models, State machine notation and Analysis Sequential circuit.

Module -1	**Teaching Hours**
Principles of combination logic: Introduction, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don't care terms) Simplifying Max term equations. **RBT: L1,L2,L3**	10 Hours
Module -2	
Applications of Combination logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Demultiplexer, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Comparators. **RBT: L1,L2,L3**	10 Hours
Module -3	
Principles of Sequential Circuits: Introduction, Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flipflops, Characteristic equations. **RBT: L1,L2**	10 Hours
Module -4	
Applications of Flip-Flops: Registers, Binary ripple counters, Synchronous binary counters, Counters based on shift registers, Design of synchronous counters, Design of a synchronous mod-n counter using clocked T, JK, D and SR flip-flops. **RBT: L1,L2,L3**	10 Hours
Module -5	
Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, Counter design. **RBT: L1,L2,L3**	10 Hours

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

- Develop simplified switching equation using Karnaugh Maps technique.
- Explain the operation of decoders, encoders, multiplexers, demultiplexers, adders, subtractors and comparators.
- Explain the working of Latches and Flip Flops (SR,D,T and JK).
- Design and develop Synchronous/Asynchronous Counters and Shift registers using Flip Flops.
- Mealy/Moore Models and state diagrams for the given clocked sequential circuits.

Text Books:

1. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001. ISBN 981-240-062-1.
2. Donald D. Givone, ―Digital Principles and Design‖, McGraw Hill, 2002. ISBN 978-0- 07-052906-9.

Reference Books:

1. D. P. Kothari and J. S Dhillon, - Digital Circuits and Design‖, Pearson, 2016, ISBN: 9789332543539
2. Morris Mano, ―Digital Design, Prentice Hall of India, Third Edition.

3. Charles H Roth, Jr., ―Fundamentals of logic design‖, Cengage Learning.
4. K. A. Navas, ―Electronics Lab Manual‖, Volume I, PHI, 5thEdition, 2015, ISBN: 9788120351424.

NETWORK ANALYSIS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	18EC34	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:

- To familiarize the basic laws, source transformations, theorems and the methods of analysing electrical circuits.

- To appreciate concept of network theorems and the concept of resonance.
- To explain importance of initial conditions and transient analysis of R-L and R-C circuits.
- To impart the basic knowledge of network analysis using Laplace transforms.
- To understand the basic knowledge of two port networks.

Module -1	**Teaching Hours**
Basic Concepts: Sources and its types, Source Transformation and Source Shifting, Network Reduction using Star Delta Transformation, Mesh Analysis, Node Analysis, Concept of Supermesh and Supernode. (For AC and DC circuits with independent and dependent sources) **RBT: L1,L2,L3**	10 Hours
Module -2	
Network Theorems: Superposition Theorem, Reciprocity Theorem, Milliam's Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. **RBT: L1,L2,L3**	10 Hours
Module -3	
Resonant Circuit: Series and Parallel Resonance, Problems on Resonant Frequency, Bandwidth and Quality Factor at Resonance. **RBT: L1,L2**	10 Hours
Module -4	
Transient Analysis: Behavior of Circuit Elements under Switching Condition, Representation, Evaluation of Initial and Final Conditions in RL and RC circuits for AC and DC Excitations. **Laplace Transform:** Solution of Networks, Step, Ramp and Impulse Responses, Waveform Synthesis **RBT: L1,L2,L3**	10 Hours
Module -5	
Two Port Network: Definition of Z, Y, h and Transmission Parameters, Modeling with these Parameters, Relationship between Parameters sets. **RBT: L1,L2,L3**	10 Hours

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

- Understand the Basic Concepts, Basic Laws and Methods of Analysis of DC and AC Networks.
- Reducing the Complexity of the Network using Different Transformation and Shifting Methods, and Solve Complex Electric Circuit Using Network Theorems.
- Discuss Resonance in Series and Parallel Circuits.
- Discuss the Importance of Initial Conditions and their Evaluation. Synthesize Typical Waveform Using Laplace Transform.
- Understand the Performance of Two Port Networks.

Text Books:

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

Reference Books:

1. Hayt, Kemmerly and Durbin ―Engineering Circuit Analysis‖, TMH 7th Edition, 2010
2. J. David Irwin, R. Mark Nelms, ―Basic Engineering Circuit Analysis‖, John Wiley, 8thed, 2006.
3. Charles K Alexander and Mathew N O Sadiku, ― Fundamentals of Electric Circuits, Tata McGraw-Hill, 3rd Ed, 2009

ANALOG CIRCUITS LAB [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	18ECL35	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03
CREDITS-01			

Course Objectives: This laboratory course will enable students to:

- Understand the working principle of Diode clipping and clamping circuits.
- Characterize the JFET and MOSFET.
- Design and evaluate the BJT and Class B push pull power amplifier.
- Realize the oscillator circuits such as RC phase shift oscillator, Colpitts, Hartley and Crystal oscillator.
- Design and realize the Adder, Differentiator, Integrator, R-2R ladder DAC, Precision full wave rectifier and Schmitt trigger circuit using Op-Amp.

- Design and realize Monostable and Astable multivibrator using 555 Timer.
- Design and realize the fixed voltage power supply using IC regulator.

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. Design and testing of diode clipping and clamping circuits.
2. Verify JFET and MOSFET characteristics.
3. Design and test the BJT amplifier circuit and obtain the frequency response characteristics.
4. Design and testing of RC phase shift oscillator, Crystal oscillator using BJT.
5. Design and testing of Colpitts oscillator, Hartley oscillator using BJT.
6. Set up and study the class B push pull power amplifier and calculate the efficiency.
7. Design and verify the operation of Op – Amp as a (a) Adder (b) Integrator and (c) Differentiator.
8. Design and realize Schmitt trigger circuit using an Op – Amp for desired upper trigger point (UTP) and lower trigger point (LTP).
9. Design and verify a Precision full wave rectifier.
10. Design of Monostable and Astable multivibrator using 555 Timer.
11. Design and realization of R – 2R ladder DAC.
12. Design of Fixed voltage power supply (voltage regulator) using IC regulator 78 series.

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

- Differentiate the various diode clipping and clamping circuits.
- Plot the transfer and drain characteristics of JFET and MOSFET.
- Design and demonstrate the BJT amplifier, Power amplifier and Oscillator circuits and evaluate their performance.
- Design and demonstrate the Adder, Differentiator, Integrator, R-2R ladder DAC, Precision full wave rectifier and Schmitt trigger circuit using Op-Amp.
- Design and demonstrate the Monostable and Astable multivibrator using 555 Timer.
- Design and construct the fixed voltage power supply using IC regulator

DIGITAL SYSTEM DESIGN LAB

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

SEMESTER-III

Subject Code	18ECL36	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03

CREDITS-01

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

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

Note:

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

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

List of Experiments:

1. Verify
   (a) Demorgan's Theorem for 2 variables.
   (b) The sum-of product and product-of-sum expressions using universal gates.
2. Design and implement
   (a) Half Adder.
   (b) Full Adder.
   (c) Full subtractor.
3. Design and implement 4-bit Parallel Adder/ Subtractor using IC 7483.
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
5. Realize 4:1 Multiplexer and 1:4 Demultiplexer using gates.
6. Realize 3:8 decoders and 8:3 encoders.
7. Realize JK, D & T Flip-Flops using NAND Gates
8. Realize the following shift registers using IC7474/IC 7495
   (a) SISO (b) SIPO (c) PISO (d) PIPO
9. Realize Ring and Johnson counter.
10. Realize Mod-N Asynchronous and Mod-N 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:

- Demonstrate the truth table of various expressions and combinational circuits using logic gates.
- Design and test various combinational circuits such as adders, subtractors, comparators, multiplexers.
- Realize Boolean expression using decoders.
  Construct and test flips-flops, counters and shift registers.

NETWORK ANALYSIS LAB

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

SEMESTER-III

Subject Code	18ECL37	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Realize the basic laws, KVL and KCL.
- Realize the network theorems.
- Calculation of frequency response, Quality, bandwidth for both series & parallel circuits.
- Analysis of Resonant Circuits.
- Calculate of 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. Analysis of series resonance.
8. Analysis of parallel resonance.
9. Determination transient behavior of RC circuits.
10. Determination transient behavior of RL circuits.
11. Determination of transient behavior of RLC circuits.
12. Study of Z & Y parameters of two port network parameters.

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

- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks.
- Reducing the complexity of the network using different transformation and shifting methods. Solve complex electric circuit using network theorems.
- Discuss resonance in series and parallel circuits.
- Discuss the importance of initial conditions and their evaluation.
- Understand the performance of two port networks.

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 (	08 Hours

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.	
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's seires 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: • Understand the fundamental concepts of complex numbers and vector algebra to analyze the problems arising in related area. • Use derivatives and partial derivatives to calculate rates of change of multivariate functions. • Learn techniques of integration including double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region. • Analyze position, velocity and acceleration in two or three dimensions using the calculu s of vector valued functions. • Recognize and solve first-order ordinary differential equations occurring in different branches of engineering. • 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.	

ENGINEERING MATHEMATICS-IV [As per Choice Based Credit System (CBCS) scheme] SEMESTER-IV			
Course Code :	18MAT41	CIE Marks :	50
Contact Hours/Week :	4L	SEE Marks:	50
Total Hours:	50	Exam Hours:	03
CREDITS-04			
Course Objectives: This course will enable students to: • Learn Fourier series and Fourier transforms. • Conversant with numerical methods to solve ordinary differential equations, complex analysis, joint probability distribution and stochastic processes arising in science and engineering.			
Module -1			**Teaching Hours**
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodicf unctions with period 2π and with arbitrary period 2c. Fourier series of even and odd functions Half range Fourier Series, practical harmonic analysis(5 Assignment Problem). **RBT: L1,L2**			10 Hours
Module -2			
Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transfor ms. Inverse Fourier-transform (5 Assignment Problem). **Complex line Integrals:** Cauchy's Integration theorem, Cauchy integral formula, Laurent's Series, types of			10 Hours

singularities. Residue, Poles, Cauchy's Residue theorem (without proof) and Problems. **Transformations:** Bilinear transformations and problems. **RBT: L1,L2**	
Module -3	
Numerical Methods: Numerical solution of ordinary differential equations of first o rder 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). **RBT: L1,L2**	10 Hours
Module -4	
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). **RBT: L1,L2**	10 Hours
Module -5	
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). **RBT:L1,L2, L3**	10 Hours

Course Outcomes: On completion of this course, students are able to:

- Know the use of periodic signals and Fourier series to analyze circuits and system communications.
- Explain the general linear system theory for continuous time signals and digital signal processing using the Fourier Transform.
- Solve first and second order ordinary differential equations arising in flow problems using single step and multistep numerical methods.
- Understand the analyticity, potential fields, residues and poles of complex potentials in field theory and electromagnetic theory.
- Describe bilinear transformation arising in aerofoil theory, fluid flow visualization and image processing.
- Solve problems on probability distributions relating to digital signal processing, information theory and optimization concepts of stability of design and structural engineering.
- Determine joint probability distributions and stochastic matrix connected with the multivariable correlation problems for feasible random events.
- Define transition probability matrix of a Markov chain and solve problems related to discrete parameter random process.

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., 2015.

Reference Books:

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics",S. Chand publishing, 1st edition, 2011.

ANALOG AND DIGITAL COMMUNICATION [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Subject Code	18EC42	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:

- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals. Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Analyze pulse modulation and sampling techniques. ·
- Understand the mathematical representation of signal, symbol, noise and channels.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

Module -1	**Teaching Hours**
Amplitude Modulation: Amplitude Modulation, Virtues, Limitations, and Modifications of Amplitude Modulation & Double Sideband-Suppressed Carrier Modulation(with derivation), Costas Receiver, Quadrature-Carrier Multiplexing, Single-Sideband Modulation and Vestigial Sideband Modulation (without derivation). (Text 1: 3.1 to 3.7), Signal to noise ratios, Noise in AM receivers using Envelope detection (Text 1: 9.2, 9.5). **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).	10 Hours

RBT: L1,L2	
Module -2	
Pulse Modulation-Transition From Analog To Digital Communications: Sampling process, Pulse Amplitude Modulation, Pulse position modulation, Completing the Transition from analog to digital, Quantization process, Pulse code modulation (PCM), Delta modulation, Differential pulse code modulation, Line codes(Text 1: 5.1to5.9). **RBT: L1,L2,L3**	10 Hours
Module -3	
Baseband Data Transmission: Baseband transmission of digital data, The inter symbol interference problem, The Nyquist channel, Baseband transmission of M-ary data, The eye pattern (Text 1: 6.1 to 6.6). **RBT: L1,L2,L3**	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), Bit Error Rate, Optimum Detection of BPSK, Optimum Detection of Binary FSK (Text 1: 10.1, 10.4, 10.6). **RBT: L1,L2,L3**	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). **RBT: L1,L2,L3**	10 Hours

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

- Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
- Analyze the behavior of a communication system in presence of noise
- Investigate pulsed modulation system and analyze their system performance
- Analyze different digital modulation schemes and can compute the bit error performance

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.

MICROCONTROLLER [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Subject Code	18EC43	CIE Marks	50
Number of Lecture Hours/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 difference between a microprocessor and a microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using assembly level language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt timers/counters and serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

Module -1	Teaching Hours
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded System, Embedded Microcontrollers (Text 1). 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory Organization, External Memory (ROM & RAM) interfacing. (Text 2) **RBT: L1,L2**	10 Hours
Module -2	
8051 Instruction Set: Addressing Modes, External Data Transfer Instructions, Logical Instructions, Arithmetic Instructions, Jump & Call Instruction. Time delay Calculation. Simple Assembly Language Program examples (without loops) to use these instructions.(Text 2 & Text 1) **RBT: L1,L2**	10 Hours
Module -3	
8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly Language Program examples on Subroutine and Involving Loops - Delay Subroutine, Factorial of a number (result maximum 8 bit), Block move without overlap, Addition of N numbers, Picking smallest/largest of N numbers (8 bit). Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.(Text 1)	10 Hours

RBT: L1,L2,L3	
Module -4	
8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly Language Programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS-232 Standard, 9 pin RS232 signals, Simple Serial Port Programming in Assembly and C to transmit a message and to receive data serially. (Text 1) **RBT: L1,L2,L3**	10 Hours
Module -5	
8051 Interrupts and Interfacing Applications: 8051 Interrupts basics, Programming Timer Interrupt, Programming External Interrupts, Programming Serial Communication Interrupt, Interrupt priority, 8051 C Programming to generate a square waveform on a port pin using a Timer Interrupt. Interfacing 8051 to LCD, Keyboard Interfacing, ADC-0804, DAC-0808 & Stepper motor and their 8051 Assembly Language Interfacing Programming. (Text 1) **RBT: L1,L2,L3**	10 Hours

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

- Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, and Interfacing of 8051 to External Memory and Instruction set of 8051.
- Write 8051 Assembly Level Programs using 8051 Instruction set.
- Explain the Interrupt System, Operation of Timers/Counters and Serial port of 8051.
- Write 8051 Assembly Language Program to generate timings and waveforms using 8051 Timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
- Write 8051 C programs to generate square wave on 8051 I/O port pin using interrupt and to send & receive serial data using 8051 serial port.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

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.

SIGNALS AND SYSTEMS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-IV			
Subject Code	18EC44	CIE Marks	50
Number 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 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 domain 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.

Module -1	**Teaching Hours**
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 interms of elementary signals. **RBT: L1,L2,L3**	10 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. LTI system Properties interms of impulse response: System interconnection, Memoryless, Causal, Stable, Invertible and Deconvolution, and step response. **RBT: L1,L2,L3**	10 Hours
Module -3	
Time domain representation of LTI System (Cont.): 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. **RBT: L1,L2,L3**	10 Hours

Module -4	
Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Periodicity, Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships and Duality. **RBT: L1,L2,L3**	10 Hours
Module -5	
Z-Transforms: Z transforms, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems. **RBT: L1,L2,L3**	10 Hours

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

- Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals.
- Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
- Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.
- Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.
- Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems.

Text Book:

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

Reference Books:

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

ANALOG AND DIGITAL COMMUNICATION LAB

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

SEMESTER-IV

Subject Code	18ECL45	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course will enable students to:

- Design, Demonstrate and Analyze filters using op-amp.
- Design, Demonstrate and Analyze analog systems for AM, FM, PPM, PAM, PWM operations.
- Design and demonstrate the digital modulation techniques
- Model an optical communication system and study its characteristics.

List of 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. Pulse amplitude modulation and detection.
5. Pulse Width modulation and detection.
6. Pulse Position Modulation and detection.
7. Time Division Multiplexing and Demultiplexing of two bandlimited signals.
8. ASK generation and detection.
9. FSK generation and detection.
10. PSK generation and detection.
11. DPSK generation and detection.
10. PCM generation and detection.
11. Measurement of propagation loss, bending loss and numerical aperture of an optical fiber.

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

- Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
- Design and test the digital modulation circuits/systems and display the waveforms.
- Design and illustrate the operation of LPF and HPF using linear IC.
- Demonstrate AM, FM, PPM, PWM and PAM operations

MICROCONTROLLERS LAB

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

SEMESTER-IV

Subject Code	18ECL46	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course enables students to :

- Write 8051 Assembly Language and C Programs for 8051.
- Interface hardware modules to Microcontroller board.
- Develop applications based on Microcontroller 8051

List of Experiments:

Software program using 8051 Microcontroller

Simple Assembly Language;

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

Hardware Programming (using 8051 With C Program)

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

SIGNALS AND SYSTEMS LAB

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

SEMESTER-V

Subject Code	18ECL47	CIE Marks	50
Number of Lecture Hour/Week	2P	SEE Marks	50
RBT Level	L1,L2,L3	Exam Hours	03

CREDITS-01

Course Objectives: This laboratory course will enable students to:

- Simulate basic signals impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
- Find the Even and Odd of the signal and Computation of Energy and Power of the signal.
- Find solution to the difference equations and computation of convolution
- Compute the DFT for a discrete signal
- Evaluate Sampling theorem

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

List of Experiments:

1. Representation of basic signals impulse, unit step, unit ramp, sinusoidal, cosine and exponential.
2. Finding Energy and power of signals.
3. Finding Even and Odd of the signal.
4. Write a program to perform Operations on signal time scaling, amplitude scaling.
5. Write a program to linear convolution of two sequences.
6. Find the Fourier transform, plot magnitude and phase.
7. Find the Inverse Fourier transform, plot magnitude and phase.
8. Find the solution of difference equation.
9. Evaluate Sampling Theorem.
10. Finding frequency response of LTI system.

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

- Understand the concepts of time scaling and amplitude scaling of signals.
- Perform convolution of given sequences to evaluate the response of a system.
- Understand the concepts of frequency domain representation of signals.
- Provide a solution for a given difference equation.
- Understand the concepts of frequency domain sampling of signals.

ADDITIONAL MATHEMATICS - II

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

SEMESTER-III

Subject Code	18MATDIP41	CIE Marks	00
Number of Lecture Hour/Week	3L	SEE Marks	100
Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives: This course will enable students to:

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

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

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

- Solve first order differential equations in the different areas of Engineering.
- Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
- Solve second order partial differential equations in the different areas in the real world.
- Recall basic concepts of elementary probability theory and, solve problems related to the decision theory, synthesis and optimization of digital circuits.
- To find the surface area and volume of 3D objects.

Text Books:

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

Reference Books:

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

Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination 2018-19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018-19)

Programme: B.Tech: Electronics and Communication Engineering

V SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSS	18ES51	Management and Entrepreneurship Development	Humanities	3	1		3	50	50	100	04
2	HCC	18EC52	Digital Signal Processing		3	1		3	50	50	100	04
3	HCC	18EC53	Electromagnetic waves and Antennas		3	1		3	50	50	100	04
4	CEC	18EC54X	Core Elective -1		3			3	50	50	100	03
5	HCC	18ECL55	Digital Signal Processing Lab				2	3	50	50	100	01
6	HCC	18ECL56	Electromagnetic waves and Antennas Lab				2	3	50	50	100	01
7	CEC	18ECL57X	Core Elective-1 Lab				2	3	50	50	100	01
8	PW	18PRJ58	Project-5				2	3	50	50	100	01
9	HSS	18HSM59	Soft Skills	Humanities	1			2	50	50	100	01
Total					**13**	**3**	**8**	**26**	**450**	**450**	**900**	**20**

Note: HCC-Hard Core Course, CEC-Core Elective Course, PW-Project Work, HSS-Humanity and Social Science

Project(PRJ): Based on the ability /abilities of the student/s and recommendations of the mentor, a single discipline or multidisciplinary mini project can be assigned to an individual students or to a group having not more than 4 students

Core Elective -1			
Course code under 18EC54X	**Course Title**	**Course code under 18ECL57X**	**Course Title**
18EC541	Verilog HDL	18ECL571	Verilog HDL Lab
18EC542	Microprocessor 8086	18ECL572	Microprocessor 8086 Lab
18EC543 (MOOCS)	Information Theory		
18EC544 (MOOCS)	Digital Image Processing		
AICTE Activity Points: In case students fail to earn the prescribed activity points, Eighth semester Grade Card shall be issued only after earning the required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.			

Sharnbasva University, Kalaburagi

Scheme of Teaching and Examination 2018-19

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2018-19)

Programme: B.Tech: Electronics and Communication Engineering

VI SEMESTER

Sl. No.	Course Code		Course Title	Teaching Department	Teaching Hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HCC	18EC61	VLSI Circuits		3	1		3	50	50	100	04
2	CEC	18EC62X	Core Elective -2		3			3	50	50	100	03
3	CEC	18EC63X	Core Elective -3		3			3	50	50	100	03
4	OEC	18XX64X	Open Elective -1		3			3	50	50	100	03
5	HCC	18ECL65	VLSI Circuits Lab				2	3	50	50	100	01
6	CEC	18ECL66X	Core Elective-2 Lab				2	3	50	50	100	01
7	CEC	18ECL67X	Core Elective-3 Lab				2	3	50	50	100	01
8	PW	18PRJ68	Project-6				2	3	50	50	100	01
9	HSS	18HSM69	Professional Ethics	Humanities	1			2	50	50	100	01
10	Internship	--	Internship	To be carried out during vacation *								
Total					**13**	**1**	**8**	**26**	**450**	**450**	**900**	**18**

Note: HCC-Hard Core Course, CEC-Core Elective Course, OEC-Open Elective Course, PW-Project Work, HSS-Humanity and Social Science
Internship-To be carried out during the vacation/s of VI and VII semesters or VII and VIII semesters

Project(PRJ): Based on the ability /abilities of the student/s and recommendations of the mentor, a single discipline or multidisciplinary mini project can be assigned to an individual students or to a group having not more than 4 students

Core Elective -2

Course code under 18EC62X	Course Title	Course code under 18ECL66X	Course Title

18EC621	ARM Cortex M3 & Embedded Systems	18ECL661	Embedded System Lab
18EC622	Machine Learning	18ECL662	Machine Learning Lab
18EC623	Satellite Communication		
18EC624	Operating System		
18EC625	MOOC (SWAYAM) SUBJECT		
Core Elective -3			
Course code under 18EC63X	**Course Title**	**Course code under 18ECL67X**	**Course Title**
18EC631	IOT Technology	18ECL671	IOT Lab
18EC632	Wireless Sensor Network	18ECL672	Wireless Sensor Network Lab
18EC633	Computer organization and architecture		
18EC634	Radar System		
18EC635	MOOC (SWAYAM) SUBJECT		
Open Elective -1			
Course code under 18XX64X	**Course Title**		
18EC641	Control Systems		
18EC642	Automotive Electronics		
AICTE Activity Points: In case students fail to earn the prescribed activity points, Eighth semester Grade Card shall be issued only after earning the required activity points. Student shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.			

MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-V			
Subject Code	18ES51	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:
- 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: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art &Profession. **Planning**: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making. **RBT: L1,L2**	10 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 and Controlling:** 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; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process. **RBT: L1,L2**	10 Hours
Module -3	
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. **Entrepreneurship:** Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. **RBT: L1,L2**	10 Hours
Module -4	

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) **Institutional Support for Business Enterprises:** Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions. **RBT: L1,L2**	10 Hours
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. **RBT: L1,L2,L3**	10 Hours

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

- Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business.
- Select a best Entrepreneurship model for the required domain of establishment.
- Describe the functions of Managers, Entrepreneurs and their social responsibilities.
- Compare various types of Entrepreneurs.
- Awareness about various sources of funding and institutions supporting entrepreneurs.
- Analyze the Institutional support by various state and central government agencies.

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.

DIGITAL SIGNAL PROCESING

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

SEMESTER-V

Subject Code	18EC52	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)** **RBT: L1,L2,L3**	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)** **RBT: L1,L2,L3**	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)** **RBT: L1,L2,L3**	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)** **RBT: L1,L2,L3**	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)** **RBT: L1,L2,L3**	08 Hours

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

- Determine response of LTI systems using time domain and DFT techniques.
- Compute DFT of real and complex discrete time signals.
- Computation of DFT using FFT algorithms and linear filtering approach.
- Digital filter design and realize using digital computations.

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.

ELECTROMAGNETIC WAVES AND ANTENNAS

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

SEMESTER-V

Subject Code	18EC53	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:

- 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.
- Acquire knowledge of Poynting theorem and its application of power flow.
- Introduce and discuss different types of Antennas, various terminologies, excitations.
- Study different types of Arrays, Pattern-multiplication, Feeding techniques.
- Study of microstrip patch antenna characteristics.

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) **RBT: L1,L2,L3**	10 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) **RBT: L1,L2,L3**	10 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(8.5,8.6,10.1,10.2,10.3,10.4,12.1,12.2,12.3) **RBT: L1,L2,L3**	10 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) **RBT: L1,L2,L3**	10 Hours
Module -5	
Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna	10 Hours

(Field Analyses), Radiation Resistances of Lambda/2 Antenna(No derivations for fields and radiation resistance).Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. Microstrip Antennas (6.1-6.6,8.3,8.5,8.8,9.5,11.7,14.1-14.5,14.13 of Text 2)**RBT: L1,L2,L3**	

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

- Evaluate problems on electric field due to point, linear, charges by applying conventional methods or by Gauss law.
- Apply Maxwell‘s equation for time varying fields, EM waves in free space.
- Evaluate power associated with EM waves using Poynting theorem.
- Classify different types of antennas.
- Define and illustrate various types of array antennas.
- Design antennas like Yagi-Uda, Helical antennas and other broad band 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.

VERILOG HDL

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

SEMESTER-V

Subject Code	18EC541	CIE Marks	50
Number of 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::

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand timing and delay Simulation.
- 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. **RBT: L1,L2,L3**	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. **RBT: L1,L2,L3**	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. **RBT: L1,L2,L3**	08 Hours
Module -4	
Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, Multiway branching, loops, sequential and parallel blocks. **RBT: L1,L2,L3**	08 Hours
Module -5	
Switch Level Modelling: Switch modeling elements: MOS Switches, CMOS Switches, Bidirectional switches,Power & Ground , Resistive Switches, Delay Specificationon Switches, Examples. **Logic Synthesis with Verilog:** Logic Synthesis, Impact of logic synthesis, Verilog HDL Synthesis, Synthesis design flow, Verification of Gate-Level Netlist**.** **RBT: L1,L2,L3**	08 Hours

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

- Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
- Design and verify the functionality of digital circuit/system using test benches.

- Identify the suitable Abstraction level for a particular digital design.
- Perform timing and delay Simulation
- Interpret the various constructs in logic synthesis.

Text Books:

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.

MICROPROCESSORS (8086)

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

SEMESTER-V

Subject Code	18EC542	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:

- 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**
8086 PROCESSOR: Historical background 8086 CPU Architecture Addressing modes, Machine language instruction formats, Machine coding the program **INSTRUCTION SET OF 8086:** Data transfer and arithmetic instructions. Control/Branch Instructions, Illustration of these instructions with example programs. **RBT: L1,L2,L3**	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. **RBT: L1,L2,L3**	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, Passing parameters to procedures, Macros, Timing and Delays. **RBT: L1,L2,L3**	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. **Basic Peripherals and their Interfacing with 8086 (Part 1)**: Static RAM Interfacing with 8086 (5.1.1), Interfacing I/O ports, PIO 8255, Modes of operation – Mode-0 and BSR Mode, Interfacing Keyboard and 7-Segment digits using 8255. **RBT: L1,L2,L3**	08 Hours
Module -5	
Basic Peripherals and their Interfacing with 8086 (Part 2): Interfacing ADC-0808/0809, DAC-0800, Stepper Motor using 8255, Timer 8254 – Mode 0, 1, 2 & 3 and Interfacing programmes for these modes. **INT 21H DOS Function calls** - for handling Keyboard and Display. **Other Architectures:** Architecture of 8088 and Architecture of NDP 8087	08 Hours

Von-Neumann & Harvard CPU architecture and CISC & RISC CPU architecture. **RBT: L1,L2,L3**	

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

- Explain the History of evaluation of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture.
- Write 8086 Assembly level programs using the 8086 instruction set.
- Write modular programs using procedures and macros.
- Write 8086 Stack and Interrupts programming.
- Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.
- Use INT 21 DOS interrupt function calls to handle Keyboard and Display

Text Books:

1.The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

2. Advanced Microprocessors and Peripherals - A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2012, ISBN 978-1-25-900613-5.

Reference Books:

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.

DIGITAL SIGNAL PROCESING LAB

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

SEMESTER-V

Subject Code	18ECL55	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 MATLAB.
- 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 laboratory course, students will be able to:

- Understanding the concept of sampling theorem.
- Working with applications of DFT
- Design and demonstrate the Adder, Differentiator, Integrator, R-2R ladder DAC, Precision full wave rectifier and Schmitt trigger circuit using Op-Amp.

ELECTROMAGNETIC WAVES AND ANTENNAS LAB

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

SEMESTER-V

Subject Code	18ECL56	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, guide wavelength, power, VSWR and attenuation in microwave test bench.
2. Measurement of directivity and gain of microstrip dipole
3. Measurement of directivity and gain of Yagi antennas.
4. Measurement of directivity and gain of horn antennas.
5. Impedance measurements of Horn/Yagi/dipole/Parabolic antennas
6. Determination of Coupling and isolation characteristics of microstrip directional coupler.
7. Resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
8. Power division and isolation of microstrip power divider.

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

- Plot the radiation pattern of antennas.
- Design antennas like Yagi-Uda, Helical antennas and other broad band antennas.
- Realize characteristics of directional coupler, Mircostrip ring resonator, Isoloator and Power divider.

HDL LABORATORY

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

SEMESTER-V

Subject Code	18ECL571	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:

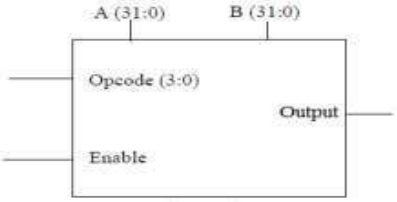
- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

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/Modelsim or equivalent.

List of Experiments:

Part–A: 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. 8 to 1 multiplexer.
    d. 4 bit binary to gray converter
    e. Multiplexer, de-multiplexer, comparator.
3. Write a Verilog code to describe the functions of a Full Adder using
4. three modeling styles.
5. Write a Verilog code to model 32 bit ALU using the schematic diagram shown



ALU should use combinational logic to calculate an output based on the four bit op-code input.
ALU should pass the result to the out bus when enable line in high, and tri-state the out bus when the enable line is low.
ALU should decode the 4 bit op-code according to the example given below.

OPCODE	ALU OPERATION
1.	A+B
2.	A-B
3.	A Complement
4.	A*B
5.	A AND B
6.	A OR B
7.	A NAND B
8.	A XNOR B

6. Develop the Verilog code for the following flip-flops, SR, D, JK and T.

7. Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous
8. reset) and ―any sequence‖ counters, using Verilog code.

Part–B: INTERFACING (at least four of the following must be covered using HDL)

9. Write HDL code to display messages on an alpha numeric LCD display.
10. Write HDL code to interface Hex key pad and display the key code on seven segment display.
11. Write HDL code to control speed, direction of DC and Stepper motor.
12. Write HDL code to accept Analog signal, Temperature sensor and display the data on LCD or Seven segment display.
13. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC - change the frequency.
14. Write HDL code to simulate Elevator operation.

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

- Write the HDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
- Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
- Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
- Interface the hardware to the programmable chips and obtain the required output.

MICROPROCESSOR LABORATORY

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

SEMESTER-V

Subject Code	18ECL572	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 precision no,s.
   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 5 code
   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.

7. **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 (8 bit)
6. Light dependent resistor (LDR), Relay and Buzzer Interface to make light operated switches

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

- Program a microprocessor to perform arithmetic, logical and data transfer applications.
- Understand assembler directives, DOS Interrupts, branch and loop operations.
- Interface a microprocessor to various devices for simple applications.
- Effectively utilize microprocessor peripherals.
- Utilize procedures and macros for modular programming.

SOFT SKILLS

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

SEMESTER-V

Subject Code	18HSM59	CIE Marks	50
Number of Lecture Hour/Week	2L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives: To enable the students to obtain the basic knowledge about Communication Skills - in the following topics:-

- The Meaning, definition, importance, purpose, process, types, barriers and Essential of communication.
- Develop reading and understanding ability.
- Learn effective writing.
- Learn how to write different types of letter.
- Case method of learning.

Module -1	**Teaching Hours**
INTRODUCTION TO COMMUNICATION: Meaning, Definition, Importance & Purpose of Communication, Process of Communication, Types of Communication, Communication network in an organization, 7c's of communication, Barriers to Communication and Essential of good Communication.	04 Hours
Module -2	
READING AND UNDERSTANDING – Reading Comprehension – Reading rate and reading comprehension, Paraphrasing, Interpretations of graphical information, Book reading and summarizing it.	04 Hours
Module -3	
EFFECTIVE WRITING. Purpose of Writing, Clarity in Writing, Principle of Effective Writing. Better writing using personal Experiences – Describing a person, situation, memorable events etc….	04 Hours
Module -4	
DRAFTING OF LETTERS: Writing different types of letters – writing for employment, joining letter, complaints & follows up , Enquiries, representation etc. Official Communication – e-mail & Social Media.	04 Hours
Module -5	
CASE METHOD OF LEARNING: Understand Case method of learning, different type of cases, overcoming the difficulties of the case method, analyzing the case. Do's & Don'ts for case preparation.	04 Hours

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

- Explain about basic of Communication.
- Develop reading and understanding ability.
- Learn effective writing.
- Learn how to write different types of letter.

- Analyze a Case study and solve.

Text Books:

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

Reference Books:

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

VLSI CIRCUITS

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

SEMESTER-VI

Subject Code	18EC61	CIE Marks	50
Number of Lecture Hour/Week	3L+1T	SEE Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS-03

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

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

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)** **RBT: L1,L2,L3**	10 Hours
Module -2	
MOS and BiCMOS Circuit Design Process: Layout Design Rules, Gate Layout, Stick Diagram, VLSI Design Flow. **Data Path Subsystems:**Addition/subtraction, Comparators, Counters, coding, Shifters, Multiplication, Division **(Text 1)** **RBT: L1,L2,L3**	10 Hours
Module -3	
Memory: SRAM, DRAM, read only memory, Serial Access Memory, programmable Logic array. Design methodology, Design Flow, Design Economics. **(Text 1)** **RBT: L1,L2,L3**	10 Hours
Module -4	
Single Stage Amplifier: Common Source Stage, Source follower, Source Follower, Common gate Stage, Cascode Stage. **(Text 2)** **RBT: L1,L2,L3**	10 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)** **RBT: L1,L2,L3**	10 Hours

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

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Interpret Memory elements along with timing considerations
- Demonstrate knowledge of FPGA based system design
- Interpret testing and testability issues in VLSI Design
- Analyze CMOS subsystems and architectural issues with the design constraints.

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

ARM CORTEX M3 & EMBEDDED SYSTEMS

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

SEMESTER-VI

Subject Code	18EC621	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**:**

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

Module -1	**Teaching Hours**
Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embeddedfirmware, Other system components**. (**Text 1: All the Topics from Ch-1 and Ch-2, excluding 2.3.3.4 (stepper motor), 2.3.3.8 (keyboard) and 2.3.3.9 (PPI) sections). **RBT: L1,L2**	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 Modelling (excluding UML), Embedded firmware design and development (excluding C language). (Text 1: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only). **RBT: L1,L2,L3**	08 Hours
Module -3	
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging (Text 1: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2,10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4 only) **RBT: L1,L2,L3**	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,	08 Hours

General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3) **RBT: L1,L2,L3**	
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, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only) **RBT: L1,L2,L3**	08 Hours

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

- Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Develop the hardware /software co-design and firmware design approaches.
- Explain the need of real time operating system for embedded system applications.

Text Books:

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.

MACHINE LEARNING

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

SEMESTER-VI

Subject Code	18EC622	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:

- Students can identify the problems for machine learning. And select the either supervised, unsupervised or reinforcement learning.
- Students can explain theory of probability and statistics related to machine learning
- Students can investigate concept learning, ANN, Bayes classifier, k nearest neighbor.
- Students have understanding of issues and challenges of Machine Learning.
- Understanding of the strengths and weaknesses of many popular machine learning approaches.

Modules	Teaching Hours
Module -1	
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm**.** **(Text 1 & Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
Decision Tree Learning and ANN: Decision tree representation, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -3	
Bayesian and Computational Learning: Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Instant Based Learning and Learning set of rules: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning. Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules.	08 Hours

(Text 1) **RBT: L1,L2,L3**	
Module-5	
Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning. **(Text 1)** **RBT: L1,L2,L3**	08 Hours

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

- Identify the characteristics of datasets and compare the trivial data and big data for various applications.
- Understand machine learning techniques and computing environment that are suitable for the applications under consideration .
- Solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
- Develop scaling up machine learning techniques and associated computing techniques and technologies for various applications. Implement various ways of selecting suitable model parameters for different machine learning techniques.
- Integrate machine learning libraries, and mathematical and statistical tools with modern technologies like distributed file system and mapreduce programming model

Text Books:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.

2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

SATELLITE COMMUNICATION

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

SEMESTER-VI

Subject Code	18EC623	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Exemplify some of the satellite systems.
- Understand the basics of satellite orbits, launching methods and radio wave propagation.
- Understand the systems associated with space and earth segment.
- Learn the designing aspects of space link.
- Understand the multiple access schemes and various satellite applications focusing various domains.

Modules	Teaching Hours
Module -1	
Overview of Satellite Systems: Introduction, frequency allocations, INTELSAT, Polar orbiting satellites. Orbits and Launching Methods: Introduction, Kepler's laws, definitions of terms for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits: calendars, universal time, Julian dates, sidereal time, the orbital plane, local mean solar time and sun synchronous orbits. **(Text 1)** **RBT: L1,L2**	08 Hours
Module -2	
The Geostationary Orbit: Introduction, antenna look angles, The polar mount antenna, limits of visibility, near geostationary obits, earth eclipse of satellite, sun transit outage, launching orbits. **Radio Wave Propagation:** Introduction, atmospheric losses, ionospheric effects, rain attenuation, other propagation impairments. **Space Segment:** Introduction, power supply, altitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem.**(Text 1)** **RBT: L1,L2**	08 Hours
Module -3	
Earth Segment: Introduction, receive-only home TV systems, Master antenna TV system, Community antenna TV system, Transmit-receive earth stations. **Space Link:** Introduction, Equivalent isotropic radiated power, transmission losses, link power budget, system noise, Carrier to noise ratio, uplink, downlink, effects of rain, combined uplink and downlink C/N ratio. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Interference: Introduction, interference between satellite circuits. **Satellite access:** Introduction, single access, pre-assigned FDMA, demand-assigned FDMA, spade system, TDMA, on board signal processing for FDMA/TDM operation, satellite switched TDMA, Code division multiple	08 Hours

access. . **RBT: L1,L2**	
Module-5	
Direct broadcast satellite (DBS) television: Introduction, orbital spacing, power rating and number of transponders, frequency and polarization, transponder capacity, bit rates for digital television, the home receiver outdoor unit (ODU), the home receiver indoor unit (IDU). **Satellite mobile services:** Introduction, VSATs, radarsat, global positioning satellite system (GPS), orbcomm and Iridium. **(Text 1)**. **RBT: L1,L2, L3**	08 Hours
Course outcomes: After studying this course, students will be able to: • Describe principles of various orbits, launch methods. • Analyze systems associated with space and earth segment. • Analyze and design the satellite communication links. • Describe different communication techniques used in satellite communication and various applications in different fields.	
Text Books: 3. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006.	
Reference Books: 1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd., 2017. 2. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015.	

OPERATING SYSTEM

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

SEMESTER-VI

Subject Code	18EC64X	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the services provided by an operating system.
- Understand how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Understand the structure and organization of the file system
- Understand interprocess communication and deadlock situations.

Modules	**Teaching Hours**
Module -1	
Introduction to Operating Systems: OS, Goals of an OS, Operation of an OS, Computational Structures,Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multiprogramming, Time Sharing Systems, Real Time and distributed Operating System **RBT: L1,L2**	08 Hours
Module -2	
Process Management: OS View of Processes, PCB, Fundamental State Transitions, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Longterm, medium term and short term scheduling in a time sharing system. **RBT: L1,L2**	08 Hours
Module -3	
Memory Management: Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, Paging Hardware, VM handler, FIFO, LRU page replacement policies. **RBT: L1,L2**	08 Hours
Module -4	
File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access. **RBT: L1,L2**	08 Hours
Module-5	
Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxe resource allocation, Resource state modelling, Deadlock detection algorithm, Deadlock Prevention. **RBT: L1,L2**	08 Hours

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

- Explain the goals, structure, operation and types of operating systems.
- Apply scheduling techniques to find performance factors.
- Explain organization of file systems and IOCS.
- Apply suitable techniques for contiguous and non-contiguous memory allocation.
- Describe message passing, deadlock detection and prevention methods..

Text Books:

Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.

Reference Books:

1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001.
2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006.
3. Design of operating systems, Tannanbhaum, TMH, 2001.

IOT TECHNOLOGY

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

SEMESTER-VI

Subject Code	18E631	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

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

Module -1	**Teaching Hours**
Internet of Things: An overview Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT. **Design Principles for Connected Devices:** Introduction, IoT/M2M Systems Layers and Design Standardization, Data Enrichment, Data Consolidation and Device Management at Gateway. **Design Principles for Web Connectivity:** Web Communication Protocols for Connected Devices, Message Communication Protocols for connected devices.(Chapter 1,2 &3 from Textbook 1) **RBT: L1,L2**	08 Hours
Module -2	
Internet Connectivity Principles: Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet and Others. **Data Collection, Storage and Computing Using a Colud 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 and Other Platforms. (Chapter 4 & 6 from textbook 1) **RBT: L1,L2**	08 Hours
Module -3	
IoT Privacy, Security and Vulnerabilities Solutions: Introduction, Vulnerabilities, Security Requirements and Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication. Security Models, Profiles and Protocols for IoT. (Chapter 10 from Textbook 1) **RBT: L1,L2**	08 Hours
Module -4	
IoT applications for smart and connected cities-Driverless vehicles, Crowdsensing,	

Smart buildings, Smart campuses, Smart grid. Internet of things for connected homes- Smart connected home stackholders, Smart home connected systems. IoT in Smart Ambulance and Emergency Medicine- IoT in Emergency medicine. (Textbook 2) **RBT: L1,L2,L3**	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, date/ Time operations, Classes, 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 of Textbook 3) **RBT: L1,L2,L3**	08 Hours

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

- Explain the architectural view of IoT, M2M communication, Examples of IoT
- Use of cloud storage in the IoT application.
- Solve the security issues faced by the students in the IoT application.
- Design various IoT applications.
- Use Python application software in the IoT application development.

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.
4. Peter Waher, Learning Internet of Things, Packet Publishing Limited, Jan 2015.

WIRELSESS SENSOR NETWORKS

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

SEMESTER – VI

Subject Code	18EC632	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. 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, Overview and Applications of Wireless Sensor Networks 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**	08 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**	08 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**	08 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**	08 Hours

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

1. Develop applications of wireless sensor actuator networks.
2. Implement the elements of distributed computing and network protocol.
3. Explore various hardware, software platforms that exist for sensor networks.

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. 2.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.
3. 3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

COMPUTER ORGANIZATION AND ARCHITECTURE

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

SEMESTER-VI

Subject Code	18EC633	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices.
- Describe memory hierarchy and concept of virtual memory.
- Illustrate organization of simple pipelined processor and other computing systems.

Module -1	**Teaching Hours**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation **(up to 1.6.2 of Chapter 1 of Text1).** **Machine Instructions and Programs**: Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point numbers, Memory location and Addresses, Memory Operations, Instructions and Instruction Sequencing **(up to 2.4.6 of Chapter 2 and 6.7.1 of Chapter 6 of Text1).** **RBT: L1,L2,L3**	08 Hours
Module -2	
Addressing modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions **(from 2.4.7 of Chapter 2, except 2.9.3, 2.11 & 2.12 of Text1).** **RBT: L1,L2,L3**	08 Hours
Module -3	
Input/Output Organizations: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Devices Requests, Direct Memory Access **(up to 4.2.4 and 4.4 except 4.4.1 of Chapter 4 of Text1).** **RBT: L1,L2,L3**	08 Hours
Module -4	
Memory System: Basic Concepts, Semiconductor RAM Memories – Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks **(5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chapter 5 of Text1).** **RBT: L1,L2,L3**	08 Hours
Module -5	
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Micro programmed Control**(up to 7.5 except 7.5.1 to 7.5.6 of Chapter 7 of Text1)** **RBT: L1,L2,L3**	08 Hours

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

- Explain the basic organization of a computer system.
- Describe the addressing modes, instruction formats and program control statement.
- Explain different ways of accessing an input/ output device including interrupts.
- Illustrate the organization of different types of semiconductor and other secondary storage memories.
- Illustrate simple processor organization based on hardwired control and micro programmed control.

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

Reference Books:

4. David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.
5. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
6. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

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RADAR SYSTEM

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

SEMESTER-VI

Subject Code	18EC634	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the Radar fundamentals and analyze the radar signals.
- Understand various technologies involved in the design of radar transmitters and receivers.
- Learn various radars like MTI, Doppler and tracking radars and their comparison

Module -1	**Teaching Hours**
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse wave form-PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. **(Chapter 1 of Text)** **RBT: L1,L2,L3**	08 Hours
Module -2	
The Radar Equation: Prediction of Range 'Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector - False Alarm Time and Probability, Probability of Detection, Radar Cross Section of Targets: simple targets –sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. **Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)** **RBT: L1,L2,L3**	08 Hours
Module -3	
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with– Power Amplifier Transmitter, Delay Line Cancelers-Frequency Response of Single Delay-Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, Digital MTI Processing–Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. **(Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse. Sequential Lobing, Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers. **(Chapter4: 4.1, 4.2, 4.3 of Text)** **RBT: L1,L2,L3**	08 Hours
Module -5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. (**Chapter 9:9.1,9.29.4, 9.5 of Text)** **Radar Receiver:** The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver,	08 Hours

Duplexers and Receivers Protectors, Radar Displays. **(Chapter 11 of Text)** **RBT: L1,L2,L3**	

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

- Describe the radar fundamentals.
- Analyze the radar signals.
- Explain the working principle of pulse Doppler radars, their applications and limitations.
- Describe the working of various radar transmitters and receivers.
- Analyze the range parameters of pulse radar system which affect the system performance.

Text Books:

Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001

Reference Books:

1. Radar Principles, Technology, Applications—ByronEdde, Pearson Education, 2004.
2. Radar Principles–Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modem Radar: Basic Principles–Mark A. RKhards, James A. Scheer, William A. Holm. Yesdee, 2013

CONTROL SYSTEMS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-VI			
Subject Code	18EC641	CIE Marks	50
Number of Lecture Hour/Week	3L	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS-04			

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 Masons' rule and various approach for the state variable analysis.
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) (Text 1: 1.1,1.2, 2.2) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
SIGNAL FLOW GRAPHS & STATE VARIABLES Transfer functions, Block diagram algebra and Signal Flow graphs. Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation. (Text 1: 2.4,2.5, 2.6, 12.1 to 12.5) **(Text1& Ref 1)** **RBT: L1,L2,L3**	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. Introduction to PI, PD and PID Controllers (excluding design). (Text 1: 5.1to 5.5,5.7) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
STABILITY ANALYSIS AND ROOT LOCUS Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, more on the Routh stability criterion, Introduction to Root-Locus Techniques ,The root locus concepts, Construction of root loci. Text 1: (6.1,6.2,6.4,6.5,6.6,7.1 to 7.3) **(Text1& Ref 1)** **RBT: L1,L2,L3**	08 Hours
Module -5	
FREQUENCY DOMAIN ANALYSIS AND STABILITY: Correlation between time and frequency response, Polar Plots, (Inverse Polar Plots excluded) , Bode Plots, Experimental determination of transfer function Mathematical	

preliminaries,Nyquist Stability criterion,Introduction to lead, lag and lead-lag compensating networks (excluding design). Text 1: (8.1 TO 8.4,9.2,9.3,10.3) **(Text1 & Ref 1)** **RBT: L1,L2,L3**	08 Hours

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

- Develop the mathematical model of mechanical and electrical systems
- Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method
- Determine the time domain specifications for first and second order systems
- Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
- Determine the stability of a system in the frequency domain using Nyquist and bode plots

Text Books:

5. 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.

AUTOMOTIVE ELECTRONICS

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

SEMESTER-VI

Subject Code	18EC642	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the basics of automobile dynamics and design electronics to complement those features.
- Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.

Module -1	**Teaching Hours**
Automotive Fundamentals Overview – Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System. **The Basics of Electronic Engine Control –** Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -2	
Automotive Control System applications of Sensors and Actuators – Typical Electronic Engine Control System, Variables to be measured. **Automotive Sensors –**Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -3	
Digital Engine Control Systems – Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Module -4	
Vehicle Motion Control– Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS). **Automotive Diagnostics–** Timing Light, Engine Analyzer, Onboard diagnostics, Off-	08 Hours

board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag systems. **(Text 1)** **RBT: L1,L2,L3**	
Module -5	
Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control. **(Text 1)** **RBT: L1,L2,L3**	08 Hours
Course outcomes: After studying this course, students will be able to: • Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry. • Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design. • Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems. • Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.	
Text Books: William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.	
Reference Books: 1. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.	

VLSI CIRCUITS LAB

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

SEMESTER-VI

Subject Code	18ECL65	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. An inverter
   ii. A Buffer
   iii. Transmission Gate
   iv. Basic/universal gates
   v. Flip flop -RS, D, JK, MS, T
   vi. Serial & Parallel adder
   vii. 4-bit counter [Synchronous and Asynchronous counter]
   viii. Successive approximation register [SAR]

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*

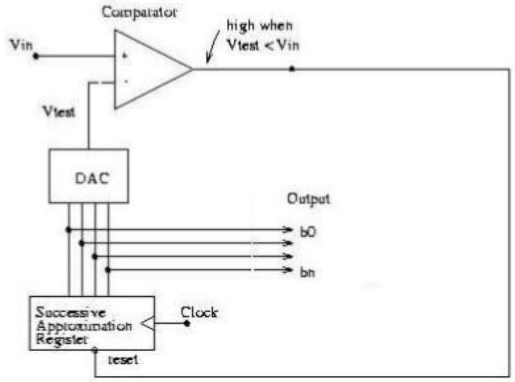
2. Design the (i) Common source and Common Drain amplifier and
   (ii) A Single Stage differential amplifier, with givespecifications**, completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis

iii) 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.

3. Design an op-amp with given specification** using given differential amplifier Common source and Common Drain amplifier in library*** and completing the design flow mentioned below:
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii). AC Analysis iii) 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.

4. Design a 4 bit R-2R based DAC for the given specification and completing the design flow mentioned using given op-amp in the library***.
   a. Draw the schematic and verify the following
   i) DC Analysis
   ii) AC Analysis
   iii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC

5. For the SAR based ADC mentioned in the figure below draw the mixed signal schematic and verify the functionality by completing ASIC Design FLOW. [Specifications to GDS-II]



* An appropriate constraint should be given.
** Appropriate specification should be given.
*** Applicable Library should be added & information should be given to the Designer.

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

- Write test bench to simulate various digital circuits.
- Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
- Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
- Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
- Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

EMBEDDED SYSTEM LAB

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

SEMESTER-VI

Subject Code	18ECL661	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:

- Understand the instruction set of ARM Cortex M3, a 32 bit microcontroller and the software tool required for programming in Assembly and C language.
- Program ARM Cortex M3 using the various instructions in assembly level language for different applications.
- Interface external devices and I/O with ARM Cortex M3.
- 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: On the completion of this laboratory course, the students will be able to:

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

IOT TECHNOLOGY LAB

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

SEMESTER-VI

Subject Code	18ECL671	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, students will be able to:

1. Explain the pin configuration and working of Respberry Pi.
2. Design of IoT application using the various sensors.
3. Design the IoT applications by using the Things speak / xtrans cloud.
4. Design the real time IoT applications.

Wireless Sensor Network Lab

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

SEMESTER-VI

Subject Code	18ECL672	CIE Marks	50
Number Lab practice Hour/Week	02	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.
2. Design a suitable network and simulate using a Network simulator tool.
3. Simulate the Sensor networking concepts and protocols using C/C++ programming.
4. List various applications of wireless and for solving wireless sensor network design issues.

Laboratory Experiments

Following Programs can be done using C/C++.

1) Write a program for first come first serve data transmission in WSN.
2) Write a program for conjestion control for a network using leakage bucket algorithm.
3) Write a program for RSA Algorithm to encrypt and decrypt the confidential data for transmission across the network.
4) Write a program for Distance vector Hop algorithm Algorithm to find the shortest path between the sensor nodes.
5) Write a program to obtain the CRC code for the given data and the generator polynomial. Verify the program without error.
6) Write a program to obtain the CRC code for the given data and the generator polynomial. Verify the program with error.

PART-B

Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet or any other equivalent tool.

Analyze the sensor network by Implementing a point to point network with four nodes and duplex links between them. set the queue size and varying the bandwidth.

7) Implement a four node point to point Sensor network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. determine the number of packets sent by TCP/UDP.
8) Implementation and create links between the source and destination using both FTP and TCP protocol for WSN.
9) create data transmission between the nodes using TCP
10) To simulate and study the Distance Vector routing algorithm using simulation.

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

1.Implement the routing protocols using C programming.

2.Use the network simulator for learning and practice of networking algorithms.

3. . Illustrate the operations of WSN network protocols and algorithms using C programming.

4 . Simulate the Sensor network with different configurations to measure the performance parameters.

Reference Book

1.WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications
By kazem sohraby daniel minoli taieb znati.

PROFESSIONAL ETHICS

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

SEMESTER-VI

Subject Code	18HSM69	CIE Marks	50
Number of Lecture Hour/Week	2L	SEE Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

CREDITS-01

Course Objectives:

- To enable the students to create an awareness on Engineering Ethics and Human Values,
- 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

- Apply ethics in society, discuss the ethical issues related to engineering
- Realize the responsibilities and rights in the society

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

COMPUTER NETWORKS

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

Subject Code	18EC71	CIE Marks	50
Number of Lecture Hour/Week	04	SEE Marks	50
Total Number of Lecture Hours	48 Hours	Exam Hours	03

CREDITS-04

Course Objectives: This course will enable students to:

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

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
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.	**10 Hours (Text1& Ref 1)**	**L1,L2,L3**
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.	**10 Hours (Text1& Ref 1)**	**L1,L2,L3**
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	**10 Hours (Text1& Ref 1)**	**L1,L2,L3**

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, **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	**10 Hours (Text1& Ref 1)**	**L1, L2,L3**
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 (Text1& Ref 1)**	**L1,L2,L3**
Course Outcomes: At the end of the course, the students will be able to: • Identify the protocols and services of Data link layer. • Identify the protocols and functions associated with the transport layer services. • Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite. • Distinguish the basic network configurations and standards associated with each network. • Construct a network model and determine the routing of packets using different routing algorithms.		
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, Wayarles Tomasi, Pearson Education, 2007, ISBN:0130138282		

POWER ELECTRONICS

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

SEMESTER-VII

Subject Code	18EC721	CIE Marks	50
Number Lecture Hour/Week	03	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 the working of various power devices.
- Study and analysis of thyristor circuits with different triggering techniques.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Study of power electronics circuits under different load conditions.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 : Introduction & Power Transistors		
Introduction - Applications of Powe,r 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**	**L1,L2**
Module -2 : Thyristors		
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 firing circuit. (Text 2)	**08 Hours**	**L1,L2, L3**
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**	**L1,L2,L3**
Module -4 : DC-DC Converters		
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**	**L1, L2**
Module-5 : Pulse Width Modulated Inverters		
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**	**L1,L2**

Course Outcomes:

- After studying this course, students will be able to:
- Describe the characteristics of different power devices and identify the applications.
- Illustrate the working of DC-DC converter and inverter circuit.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

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.

IMAGE AND VIDEO PROCESSING

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

SEMESTER-VII

Subject Code	18EC722	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- To study the image fundamentals and mathematical transforms necessary for image Processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- 4. To study the image compression procedures.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Fundamentals of Image Processing and Image Transforms: Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing. Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.	**08 Hours**	**L1,L2,L3**
Module -2		
Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothingspatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Image Restoration: Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution.	**08 Hours**	**L1,L2,L3**
Module -3		
Image Segmentation: Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour Image Compression: Introduction, Need for image compression, Redundancy in	**08 Hours**	**L1,L2,L3**

images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.		
Module -4		
Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.	**08 Hours**	**L1, L2,L3**
Module-5		
2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.	**08 Hours**	**L1,L2,L3**

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

- Defining the digital image, representation of digital image, importance of image resolution, applications in image processing.
- Know the advantages of representation of digital images in transform domain, application of various image transforms.
- Know how an image can be enhanced by using histogram techniques, filtering techniques etc and Understand image degradation, image restoration techniques using spatial filters and frequency domain
- Know the detection of point, line and edges in images, edge linking through local processing, global processing and Understand the redundancy in images, various image compression techniques.
- Know the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing and to Know the general methodologies for 2D motion estimation, various coding used in video processing.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rdEd., Pearson.
2. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang.1st Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, TataMcGraw Hill publishers, 2009

Reference Books:

1.Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – ScotteUmbaugh, 2nd Ed, CRC Press, 2011.
2.Digital Video Processing – M. Tekalp, Prentice Hall International.
3.Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH, 2009.
4.Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2ndEd, Elsevier.
5.Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier. 6.Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5tEd., Elsevier

LOW POWER VLSI DESIGN [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-VII			
Subject Code	18EC723	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			

Course Objectives: This course will enable students to:

- 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.
- Describe the various power reduction and the power estimation methods.
- Explain power dissipation at all layers of design hierarchy from technology, circuit, logic, architecture and system.
- Apply State-of-the art approaches to power estimation and reduction.
- Practice the low power techniques using current generation design style and process technology

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy(RBT) Level**
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	L1, L2
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	L2,L3
Module -3		
Probabilistic Power Analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.	08 Hours	L1, L2, L3
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	L1,L2, L3, L4
Module -5		
Logic: Gate reorganization, signal gating, logic	08 Hours	L2, L3

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.		

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

- Identify the sources of power dissipation in CMOS circuits.
- Perform power analysis using simulation based approaches and probabilistic Analysis
- Use optimization and trade-off techniques that involve power dissipation of digital circuits.
- Make the power design a reality by making power dimension an integral part of the design process
- Use practical low power design techniques and their analysis at various levels of design abstraction and analyse how these are being captured in the latest design automation environments.

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.

PROGRAMMING IN PYTHON

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

Subject Code	18EC724	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Learn the syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, dictionaries, tuples, strings.
- Illustrate the object-oriented programming concepts in Python and understand the database handling and creation of GUI.
- Understand how to handle exceptions and how to use different types of files.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Introduction to Python, use IDLE to develop programs, Basic coding skills, work with data types and variables, work with numeric data, work with string data, python functions, Boolean expressions, selection structure, iteration structure.	**08 Hours (Text 1)**	**L1,L2**
Module -2		
Working with lists, work with a list of lists, work with tuples, get started with dates and times, get started with dictionaries, recursion and algorithms.	**08 Hours (Text 1)**	**L1,L2**
Module -3		
An introduction to classes and objects, define a class, work with encapsulation, work with inheritance, Polymorphism.	**08 Hours (Text 1)**	**L1,L2**
Module -4		
An Introduction to relational databases, SQL statements for data manipulation, Use SQLite Manager to work with a database, Use Python to work with a database, Create a GUI that handles an event, work with components.	**08 Hours (Text 1)**	**L1, L2,L3**
Module-5		
How to work with file I/O: An introduction to file I/O, How to use text files, CSV files, Binary files. How to handle exceptions: Single and multiple exceptions.	**08 Hours (Text 1)**	**L1,L2,L3**

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

- Interpret the basic principles of Python programming language.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and

strings

- Articulate the Object-Oriented Programming concepts.
- Implement database and GUI applications.
- Handling exceptions and using different types of files.

Text Books:

1. Michael Urban and Joel Murach," Python Programming", Shroff/Murach, 2016.

Reference Books:

1. Mark Lutz, "Programming Python", O`Reilly, 4th Edition, 2010
2. Al Sweigart, "Automate the Boring Stuff with Python practical programming for total beginners",1st Edition, No Starch Press, 2015.

DSP Algorithms and Architecture

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

SEMESTER-VII

Subject Code	18EC731	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

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

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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**	**L1,L2**
Module -2		
TMS320C54xx Architecture: Introduction, Architectural overview of TMS320C54xx 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**	**L1,L2,L3**
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**	**L1,L2,L3**
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	**08 Hours**	**L1, L2,L3**

pipeline, Data memory, External Bus, External memory Interfacing, External memory signal generated by 54xx, Memory Address decoding, Interfacing Parallel and I/O Devices.		
Module-5		
Interfacing and Applications of DSP Processors: Introduction, DSP based measurement system, Heart rate monitor, Speech Processing System	**08 Hours**	**L1,L2,L3**

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

- Comprehend the knowledge and concepts of digital signal processing techniques.
- Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.
- Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
- Develop basic DSP algorithms using DSP processors.
- Able to interface memory and I/O devices to DSP processor

Text Books:

1. "Digital Signal Processors" Andhe Pallavi 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.

OPTICAL COMMUNICATION AND NETWORKS

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

SEMESTER-VII

Subject Code	18EC732	CIE Marks	50
Number of Lecture Hour/Week	03	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 lightpropagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Learn the network standards in optical fiber and understand the network architectures along withits functionalities.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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.	**08 Hours (Text 2)**	**L1,L2**
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 Isolatorsand Circulators**.**	**08 Hours (Text2)**	**L1,L2**
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	**08 Hours (Text1)**	**L1,L2**

Quantum Efficiency, Resonant Frequencies. **Photodetectors**: Physical principles of Photodiodes, Photo detector noise, Detector responsetime. **Optical Receiver:** Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit.		
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, Wideband Optical Amplifiers.	**08 Hours (Text1)**	**L1, L2**
Module-5		
Optical Networks: Optical network evolution and concepts: Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, Public telecommunication network overview. Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks.	**8 Hours (Text2)**	**L1,L2**

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

- Classification and working of optical fiber with different modes of signal propagation.
- Describe the transmission characteristics and losses in optical fiber communication.
- Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
- Describe the constructional features and the characteristics of optical Sources and detectors.
- Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Text Books:

1. Gerd Keiser , Optical Fiber Communication, 5thEdition, McGraw Hill Education(India) Private Limited, 2015.ISBN:1-25-900687-5.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3 Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3

Reference Books:

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

SMART AGRICULTURE

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

Subject Code	18EC733	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to

- Focus on sustainable soil and land management for climate-smart agriculture.
- 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.
- Understanding concept of various sensors used for agriculture
- Understanding communication standards used to collect the data from sensor
- Learn how to Monitor the plant health

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
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**	**L1,L2**
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**	**L1,L2**
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**	**L1,L2**
Module -4		
Telemetry: Wireless communication modules and topology, Zig-bee, Bluetooth, LORA, Zero power devices, Energy Harvesting technology	**8 Hours**	**L1, L2,L3**
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	**8 Hours**	**L1,L2,L3**

agriculture		

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

- Soil science , Plant anatomy and health monitoring
- Sensors and actuators for farming tools , sensor data acquisition and telemetry
- Advanced technologies for smart farming.
- Developing prototypes for measuring soil quality
- Developing prototype for weather monitoring system

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.

Cryptography And Network security

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

SEMESTER-VII

Subject Code	18EC734	IA Marks	50
Number of Lecture Hours/Week	03	Exam Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: Course Objectives: This course will enable students to:

- Know about security concerns in Email and Internet Protocol.
- Understand cyber security concepts.
- List the problems that can arise in cyber security.
- Discuss the various cyber security frame work.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Services, mechanisms and attacks, The OSI security architecture, A model for network security Symmetric Cipher Model.	**08 Hours**	**L1, L2**
Module -2		
Substitution Techniques, Transposition Techniques, Simplified DES, Data encryption standard (DES), The strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher.	**08 Hours**	**L1, L2**
Module -3		
Principles of Public-Key Cryptasystems, The RSA algorithm, Key Management, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Authentication functions, Hash Functions.	**08 Hours**	**L1, L2, L3**
Module -4		
Web Security Consideration, Security socket layer (SSL) and Transport layer security, Secure Electronic Transaction.	**8 Hours**	**L1, L2**
Module -5		
Viruses and Related Threats,Virus Countermeasures. Firewalls Design Principles, Trusted Systems.	**8 Hours**	**L1, L2**

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

- Explain network security protocols
- Understand the basic concepts of cyber security
- Discuss the cyber security problems
- Explain Enterprise Security Framework
- Apply concept of cyber security framework in computer system administration

Text Book:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 2nd and 6th Edition, 2014, ISBN: 978-93-325-1877-3.

Reference Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

ROBOTICS

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

Subject Code	18EC741	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

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**	**Revised Bloom's Taxonomy (RBT) Level**
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.	**08 Hours**	**L1,L2**
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.	**08 Hours**	**L1,L2**
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.	**08 Hours**	**L1,L2,L3**
Module -4		
ROBOT MOTION ANALYSIS : Robot motion analysis and control: Manipulator kinematics	**08 Hours**	**L1, L2,L3**

-forward and inverse kinematics		
Module-5		
ROBOT APPLICATIONS : Industrial and non industrial robots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear plants.	**08 Hours**	**L1,L2,L3**

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

- Have sound knowledge of Basic Robotic model.
- Differentiate types of control and the standardization for some robotic system.
- Critically evaluate robots for particular applications.
- Analyze particular industrial applications.
- Evaluate possible solutions in terms of automated, dedicated / flexible or mixed manual/ automated systems.

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

3D PRINTING TECHNOLOGY

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

SEMESTER-VII

Subject Code	18XX742	CIE Marks	50
Number Lecture Hour/Week	3	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			

Course Objectives: This course will enable students :

• Understand the basic concepts and nuances of 3D Printing Technology

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats	**08 Hours**	**L1,L2**
Module -2		
PRINCIPLE Processes – Extrusion, Wire, Granular, Lamination, Photo-polymerisation; Materials – Paper, Plastics, Metals, Ceramics, Glass, Wood, Fibre, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection – Processes, applications, limitations.	**08 Hours**	**L1,L2,L3**
Module -3		
INKJET TECHNOLOGY Printer – Working Principle, Positioning System, Print- head, Print bed, Frames, Motion control; Print-head Considerations -Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication -Continousjet, Mulitjet; Powder based fabrication – Color-jet.	**08 Hours**	**L1,L2,L3,L4**
Module -4		
LASER TECHNOLOGY Light Sources – Types, Characteristics; Optics – Deflection,Modulation; Material feeding and flow – Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print-bed Movement, Support structures.	**08 Hours**	**L1, L2,L3,L4**
Module-5		
INDUSTRIAL APPLICATIONS Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Opensource; Future trends.	**08 Hours**	**L1,L2,L3**

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

- Learn 3D printing workflow
- Understand the basic types of 3D Printing, materials used and their applications
- Understand how position and orientation affects the build's properties.
- Ability to understand details of product design.
- Select appropriate method for designing and modeling applications

NEURAL NETWORK AND DEEP LEARNING
[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-VII

Subject Code	18XX743	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	48	Exam Hours	03

CREDITS-03

Course Objectives:

- This course covers the fundamentals from Artificial Neural Network to the current trending topic of Convolution Neural Network.
- Deep Learning is one of the most exciting and promising segments of Artificial Intelligence and machine learning technologies.
- However, with the increased availability of vast amounts of data and computational capability, it has evolved to a field of its own.
- In the last few years with numerous applications in computer vision, speech analysis, healthcare, agriculture, and understanding climate change etc.
- Thus this course aims to provide basic knowledge about the deep learning.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS Fundamentals Of Neural Networks – Model of Artificial Neuron – Neural Network Architectures – Learning Methods – Taxonomy Of Neural Network Architectures – Applications	**08 Hours**	**L1,L2**
Module -2		
FEED FORWARD NEURAL NETWORKS Perceptron Models: Discrete, Continuous and Multi-Category – Training Algorithms: Discrete and Continuous Perceptron Networks – Limitations of the Perceptron – Model. Credit Assignment Problem – Generalized Delta Rule, Derivation of Back propagation (BP) Training, and Summary of Back propagation Algorithm – Kolmogorov Theorem	**08Hours**	**L1,L2,L3**
Module -3		
OTHER ANN ARCHITECTURES Associative Memory – Exponential BAM – Associative Memory For Real Coded Pattern Pairs – Applications Adaptive Resonance Theory – Introduction – ART 1 – ART2 – Applications – Neural	**08Hours**	**L1,L2,L3**

Networks Based On Competition – Kohenen Self Organizing Maps – Learning Vector Quantization – Counter Propagation Networks – Industrial Applications		
Module -4		
DEEP LEARNING Deep Feed Forward network, regularizations, training deep models, dropouts, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, vanishing and exploding Gradient problems, Gradient- Descent Strategies	**08 Hours**	**L1, L2,L3**
Module-5		
CONVOLUTIONAL NEURAL NETWORK Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGG- Net, GoogLeNet, Applications of CNN– Object Detection, Content based image Retrieval.	**08 Hours**	**L1,L2,L3**

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

- Explain the basic concepts in Neural Networks and applications
- Discuss feed forward networks and their training issues
- Distinguish different types of ANN architectures
- Explain the deep learning concepts using Back Propagation Network
- Discuss Convolutional Neural Network models to Object

Text Books:

1. CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018
2. Satish Kumar, "Neural Networks, A Classroom Approach", Tata McGraw -Hill, 2007

Simon Haykin, "Neural Networks, A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman, 2001

Reference Books:

1. "Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006
2. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY:Wiley-Interscience, 2000

SIGNAL PROCESSING

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

SEMESTER-VII

Subject Code	18EC744	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand, represent and classify continuous time and discrete time signal and systems, together with the representation of LTI systems.
- Ability to represent continuous time signals (both periodic and non periodic) in the time domain, s-domain and frequency domain.
- Understand the properties of analog filters, and have the ability to design Butterworth filters.
- Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
- Able to represent the discrete time signal in the frequency domain.
- Able to design FIR and IIR filters to meet given specifications

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Signal definition, signal classification, system definition, system classification, for both continuous time and discrete time. Definition of LTI systems.	**08 Hours**	**L1,L2**
Module -2		
Introduction to Fourier transform, Fourier series, relating the Laplace transform to Fourier transform, frequency response of continuous time systems.	**08 Hours**	**L1,L2**
Module -3		
Frequency response of ideal analog filters, silent features of Butterworth filter design and implementation of analog Butterworth filters to meet given specifications.	**08 Hours**	**L1,L2,L3**
Module -4		
Sampling theorem- statement and proof, converting the analog signal to a digital signal. Practical sampling. The discrete Fourier transform, Properties of DFT, comparing the frequency response of analog and digital systems.(FFT not included)	**08 Hours**	**L1, L2,L3**
Module-5		
Definition of FIR and IIR filters. Frequency response of ideal digital filters transforming the analog Butterworth filter to the digital IIR filter using suitable mapping techniques, to meet given specifications. Design of FIR	**08 Hours**	**L1,L2,L3**

filters using the window techniques and frequency mapping technique to meet given specifications comparing the designed filter with the desired filter frequency response		

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

- Understand and explain continuous time and discrete time signals and systems, in time and frequency domain.
- Apply the concept of signals and systems to obtain the desired parameter/representation.
- Analyze the given system and classify the systems /arrive at a suitable conclusion.
- Design analog/digital filters to meet given specifications.
- Design and implement the analog filter using components/suitable simulation tools, digital filters (FIR/IIR) using suitable simulation tools and record the input and output of the filter for the given audio signal.

Text Books:

1. 'Signal and Systems', by Simon Haykin and BarryVan Veen, Wiley.

Reference Books:

1.' Theory and Application of Digital Signal Processing', Rabiner and Gold
2. 'Signal and Systems', Schaum's outline series.
3. 'Digital Signal Processing', Schaum's outline series.

COMPUTER NETWORKS LAB

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

Subject Code	18ECL75	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
- Design a suitable network and simulate using a Network simulator tool.
- Simulate the networking concepts and protocols using C/C++ programming.
- 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: On the completion of this laboratory course, the students will be able to:

- Use the network simulator for learning and practice of networking algorithms.
- Illustrate the operations of network protocols and algorithms using C programming.
- Simulate the network with different configurations to measure the performance parameters.
- Implement the data link and routing protocols using C programming.

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: 0-273-76896-4.

POWER ELECTRONICS LAB

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

SEMESTER-VII

Subject Code	18ECL761	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:

- SCR, DIAC Static characteristics
- Static characteristics of MOSFET and IGBT
- Controlled Rectifiers
- SCR Turn off & UJT firing circuit circuits.
- Voltage (Impulse) commutated choppers.
- AC voltage controllers & controlled rectifiers.
- 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: At the end of the course the student will be able to:

- Recognize and demonstrate functioning of semiconductor power devices.
- Understands the basics in the electric power conversion using power switching devices and power converters.
- Evaluate the characteristics, switching, power conversion and control by semiconductor power devices.

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.

IMAGE AND VIDEO PROCESSING LAB

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

SEMESTER-VII

Subject Code	18ECL762	CIE Marks	50
Number of Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- To introduce the concepts of image processing and basic analytical methods to be used in image processing.
- To familiarize students with image enhancement and restoration techniques.
- To familiarize students with image compression techniques.
- To introduce segmentation and morphological processing techniques.
- To familiarize students with edge detection.

Laboratory Experiments

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

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, students will be able to:

- Understand the basic concepts of image processing techniques.
- Understand image enhancement and restoration techniques.
- Understand image smoothening/sharpening/compression techniques.
- Understand segmentation/ morphological processing /edge detection techniques.

Reference Book :

1. Digital Image Processing – Gonzaleze and Woods, 3rdEd., Pearson.

LOW POWER VLSI DESIGN LAB

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

SEMESTER-VII

Subject Code	18ECL763	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Understand the different parameters which are going to effect on power.
- Understand the different types of power dissipations.
- Learn different types of low power VLSI designs techniques.
- Learn the use of different EDA tools.
- 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, students will be able to:

- Understand the different parameters which are going to effect on power.
- Understand the different types of power dissipations.
- Implementing different types of low power VLSI designs techniques.
- Comparative study on power dissipation of various techniques..
- Design and realization of CMOS Digital circuits.

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”

PYTHON LAB

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

Subject Code	18ECL764	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: This course will enable students to:

- Write, test and debug simple python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.
- Program using different libraries available.

Laboratory Experiments

Following experiments are to be done using Python

1. Write a program to demonstrate basic data type in python.
2. Write a program to demonstrate list and tuple in python.
3. Write a program to print date, time for today and now in python.
4. Write a program to display welcome to SHARNBASVA UNIVERSITY by using classes and objects.
5. Write a program to count frequency of characters in a given file.
6. Write a program to compute GCD and LCM of two numbers.
7. Write a program for checking the given number is even or odd.
8. Write a program to print the factorial of number.
9. Write a program to check whether a given number is palindrome or not.
10. Using a numpy module create an array and check the following:

    a. Type of array b. Axes of array c. Shape of array

    d. Type of elements in array.

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

- Apply the basics of programming in the Python language.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples and dictionaries for representing compound data.
- Handle files using python.

Reference Books:

1. Mark Lutz, "Programming Python", O`Reilly, 4th Edition, 2010
2. Al Sweigart, "Automate the Boring Stuff with Python practical programming for total beginners",1st Edition, No Starch Press, 2015.

DSP ALGORITHM AND ARCHITECTURE LAB

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

SEMESTER-VII

Subject Code	18ECL771	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: This course will enable students to:

- Use of instruction set of TMS320C54xx DSP processor to develop ALP for DSP algorithms.
- Learn ALP programming for TMS320C54xx
- Learn the use of Code Composer Studio (CCS) IDE software.
- Understand the design and realization of Digital FIR and IIR filter
- 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, students will be able to:

- Use of instruction set of TMS320C54xx DSP processor to develop ALP for DSP algorithms.
- Implementing the DSP algorithms in ALP
- Use of Code Composer Studio (CCS) IDE software.
- Design and realization of Digital FIR and IIR filter
- Design and realization of Decimation and Interpolation filters

Reference Book

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

OPTICAL COMMUNICATION AND NETWORKING LAB

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

Subject Code	18ECL772	CIE Marks	50
Number of Lecture Hour/Week	02 Hrs	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Performance comparison of optical link using LED and LASER for specific distance.
- Performance Evaluation of Point to point optical link at different distances and for different transmitter powers.
- Performance comparison of optical link receivers and for different fibers.
- Impact of optical amplifiers on link performance.

Experiments

1. To study the VI & PI characteristics of the FO-LED.
2. To study the VI &PI characteristics of the Laser Diode.
3. Real time Temperature sensor data transfer using fiber optic
4. To study the transfer Characteristics between the DETECTOR and SOURCE with simplex cable.
5. To study the VOICE communication over the fiber optic cable.
6. To study Voice communication using CODEC.
7. To study PWM signal communication using fiber optic.
8. To study digital data transmission with LED and switch.
9. To study the RS232 interface for PC communication.
10. Measurement of Bit Error Rate
11. Study of free space communication system
12. Pulse Broadening in Fibre Optic Communication

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

- Recognize and classify structures of Optical fibers.
- Understand channel impairments like losses and dispersion.
- Classify optical sources and detectors with their principles.
- Get a basic understanding of optical components.
- Analyze and design long distance optical communication link for high speed optical network.

Reference Books:

1. Gerd Keiser, "Optical Fiber Communication" McGraw – Hill International, 4th Edition 2010.

2. John M Senior, “Optical Fiber Communication” 2nd Edition, Pearson Education, 2007.
3. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.
4. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

SMART AGRICULTURE LAB

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

SEMESTER-VII

Subject Code	18ECL773	CIE Marks	50
Number Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Know the applications of various sensors used in agriculture
- Learn the various crops cultivated in the local area and crop diseases
- Implement the prototype for soil nutrients detection system
- Implement the prototype for measurement of soil PH value.
- Implement a prototype for IoT based weather reporting system

Laboratory Experiments

1. Study of various sensors used in the modern agriculture: Temperature and humidity sensor, Soil moisture sensor, NPK sensor, RFID, PIR sensor, LDR etc.
2. Study of major field crops cultivated in the Kalaburagi district and crop diseases.
3. Measure Soil Nutrient using Arduino & Soil NPK Sensor.
4. Monitoring the soil moisture using the adrino microcontroller
5. Determination of PH value of a soil using adrino microcontroller
6. IoT based Temperature and humidity measurement system for green houses
7. Monitoring of light intensity in green house using adrino microcontroller
8. REID sensing technology based smart agriculture system

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

- Use the various sensors for smart agriculture
- Know the various crops cultivated locally and crops affected by various diseases
- Build the prototype for soil nutrients detection system
- Build the prototype for measurement of soil PH value.
- Build the prototype for IoT based weather reporting system

References

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3. Beza Negash Getu; Hussain A. Attia, Automatic control of agricultural pumps based on soil moisture sensing, AFRICON 2015, DOI: 10.1109/AFRCON.2015.7332052
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6. Devanath S, Hemanth Kumar A.R, Rachita Shettar, Design and Implementation of IOT Based Greenhouse Environment Monitoring and Controlling System Using Arduino Platform, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 09, Sep 2019.
7. Rakiba Rayhana, Gaozhi Xiao, and Zheng Liu, RFID Sensing Technologies for Smart Agriculture, Article in IEEE Instrumentation and Measurement Magazine · May 2021 DOI: 10.1109/MIM.2021.9436094.
8. "(PDF) Smart Plant Monitoring System." [Online]. Available: https://www.researchgate.net/publication/283123947_Smart_Plant_Monitoring_System. [Accessed: 04-Apr-2019.

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12. R. Dagar, S. Som, and S. K. Khatri, “Smart Farming - IoT in Agriculture,” 2018 Int. Conf. Inven. Res. Comput. Appl., no. Icirca, pp. 1052–1056, 2018.
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16. N. Kaewmard and S. Saiyod, “Sensor data collection and irrigation control on vegetable crop using smart phone and wireless sensor networks for smart farm,” ICWiSe 2014 - 2014 IEEE Conf. Wirel. Sensors, pp. 106–112, 2014.

CRYPTOGRAPHY & NETWORK SECURITY LAB

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

SEMESTER-VII

Subject Code	18ECL774	CIE Marks	50
Number of Lab practice Hour/Week	02	SEE Marks	50
Total Number of Hours	24	Exam Hours	03

CREDITS-01

Course Objectives: This course will enable students to:

- Learn to implement Substitution & Transposition Techniques.
- Learn to implement the algorithms DES, RSA,MD5,SHA-1
- Learn to use network security tools like GnuPG, KF sensor, Net Strumbler.

Laboratory Experiments

1. Implement the following substitution & transposition techniquesconcepts:
   a) Caesar cipher
   b) Playfair cipher
   c) Hill cipher
   d) Vigenere cipher
   e) Rail fence – row & column transformation.
2. Implement the following algorithms
   a) DES
   b) RSA Algorithm
   c) Diffiee-Hellman
   d) MD5
   e) SHA-1
3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and forcreating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor)
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)

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

- Learn to implement Substitution & Transposition Techniques.
- Learn to implement the algorithms DES, RSA,MD5,SHA-1
- Learn to use network security tools like GnuPG, KF sensor, Net Strumbler.

Reference Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

INDUSTRIAL PSYCHOLOGY AND ORGANISATIONAL BEHAVIOUR

B.Tech, VII Semester, Electronics & Communication Engineering

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

Subject Code	18HSM79	CIE Marks	50
Number of Lecture Hour/Week	01	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**	**Revised Bloom's Taxonomy (RBT) Level**
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**	**L1,L2**
Module -2		
Organisational communication: Types of organizational communication, interpersonal communication, improving employee communication skills. (Chapter-11)	**3 Hours**	**L1,L2**
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**	**L1,L2**
Module -4		
Group behaviour- teams and conflicts Group dynamics, factors affecting group performance, individual versus group performance, group conflicts. (Chapter-13)	**5 Hours**	**L1, L2**
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**	**L1,L2**

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

1. Comprehend the knowledge and concepts of human psychology
2. know the importance of psychology
3. have insight into individual and group behavior
4. deal with people in better way
5. motivate groups and build groups

Text Book: Michael G.Aamodt, Industrial/Organizational Psychology: An Applied Approach, 6th Edition, Wadsworth Cengage Learning, ISBN: 978-0-495-60106-7.

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4. Schermerhorn J.R.Jr., Hunt J.G &Osborn R.N., Managing, Organizational Behaviour, John Willy