JSS MAHAVIDYAPEETHA

JSS SCIENCE AND TECHNOLOGY UNIVERSITY, MYSURU

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS I TO IV SEMESTER: 2017-2018

.

I/II SEMESTERS

EC110 ELECTRONIC DEVICES AND CIRCUITS

Course code	Course title	Hours/week			Credits	CIE	SEE	Total
		L	T	P				
EC 110	**Electronic devices and circuits**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

L: Lecture Hours / week;

T- Tutorial Lecture Hours / week;

P-Practical Lecture Hours / week;

CIE- Continuous Internal Evaluation;

SEE- Semester End Examination (three hours duration)

Course outcomes:

Upon the completion of this course student should be able to:

1. Understand the working principle of semiconductor diodes and Construct rectifiers, clippers, clampers and regulator circuits.
2. Understand circuits using BJT and analyze bias stabilization.
3. Analyze the working of JFET and amplifier circuits using JFET, Understand the construction of VMOS and CMOS.
4. Identify the need of operational amplifiers IC and basic circuit configurations as per the application and acquaintance with CRO's.
5. Perform the operations using number system, realize logic circuits.

Syllabus:

Unit 1: Semiconductor diodes

Semiconductor diodes-biasing and their significance, temperature effects, diode resistances, equivalent circuits, diode capacitances and switching times, load line analysis for diodes, zener diodes - rectifiers, filters, voltage regulators (discrete and integrated), clipping circuits and clamping circuits. Numerical problems. **12 hrs**

Unit 2: Bipolar transistors and biasing

Transistor construction and working, configurations, amplifying action, operating point, load line and biasing, types of biasing, bias stabilization and stability factors. Numerical problems. **10 hrs**

Unit 3: Field effect transistors

Construction and characteristics of field effect transistors (FET's), metal oxide semiconductor field effect transistor (MOSFET's) and its types, characteristics, Vertical-groove metal oxide semiconductor (VMOS) and complementary metal oxide semiconductor (CMOS) devices, Numerical problems. **10 hrs**

Unit 4: Operational amplifiers and Cathode Ray Oscilloscopes

Introduction, operating modes, characteristics, equivalent circuit, virtual ground, basic applications and practical circuits, Numerical problems.

Cathode ray oscilloscope features, block diagram, focusing with electric and magnetic fields, deflection mechanism and synchronization, practical applications, dual beam and dual trace CROs. **10 hrs**

Unit 5: Introduction to digital electronics

Review of number systems and conversions, 1's complement and 2's complement, arithmetic operation with signed numbers, logic gates, Boolean algebra, simplification and realization of Boolean expressions, half and full adder / subtractor circuits. **10 hrs**

Text books:

1. Robert Boylstad and Louis Nashelsky: *Electronic devices and circuit theory* 10th Ed, Pearson Education 2012.
2. Floyd and Jain: *Digital fundamentals* 8th Ed, Pearson Education 2007.
3. H. S. Kalsi: *Electronic Instrumentation* 3rd Ed, Tata MacGraw Hill, 2010.

Reference books:

1. Jacob Millman and Arvin Grabel: *Micorelectronics* II Ed, McGraw- Hill
2. Morris Mano: *Digital Logic and Computer design* Prentice Hall of India

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EC 21L: Basic Electronics Laboratory

Course code	Course title	Hours/week			Credits	CIE	SEE	Total
		L	T	P				
EC 21L	**Electronics lab**	**-**	**-**	**1.5**	**2**	**30**	**20**	**50**

Course outcomes:

Upon completion of the course student should be able to:

1. Familiarize with measuring instruments, their specifications, various passive and active electronic components identification and testing, reading data sheets of individual electronic devices.
2. Design and testing of single stage RC filters, different application of diodes namely, rectifiers, regulators, clippers, clampers etc.,
3. Determine input/output characteristics of bipolar junction transistor (BJT) / field effect transistor (FET) and finding out related parameters.
4. Design and testing of operational amplifier (Op-amp) circuits - inverting, non-inverting (ac/dc) summer and subtractor circuit.
5. Verify experimentally the truth tables for basic logic gates, several combinational circuits and seven segment displays.

Introductory classes:

1. Operation and settings of basic instruments like cathode ray oscilloscope, multi meter, signal generator, power supply etc.
2. Identification, specifications, testing of passive and active components and reading data sheets of individual electronic devices.

List of experiments:

1. Experimental determination of V-I characteristics of diodes (Junction diodes – Forward bias and point contact diodes- Reverse bias). Calculation of static, dynamic and reverse resistance from results and comparing it with the theoretical values.
2. Design of low pass and high pass RC circuits (single stage) and plotting the frequency response. Measurement and calculation of phase difference between i) input and output signal, ii) rise time and fall time.
3. Experimental determination of Zener as a voltage regulator. Plotting the graph of line and load regulation from experimental values. Design and testing of voltage regulator using three pin IC regulator.
4. Design and testing of half wave and full wave rectifiers (two and four diodes) with and without filters. Comparison of practical values with theoretical values.
5. Design and testing of clipping and clamping circuits.
6. Experimental determination of input and output characteristics of BJT and finding out related parameters.
7. Experimental determination of output and transfer characteristics of FET and finding out related parameters.
8. Design and testing of basic Op-amp circuits.
9. Verification of truth tables for logic gates and De Morgan's theorem.
10. Building and testing of simple combinational logic circuits.
11. Verification of seven segment displays.

III SEMESTER

EC 310: Circuit Theory and Analysis

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 310	**Circuit Theory and Analysis**	**3**	**1**	**0**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Use network solution techniques, like nodal analysis and mesh analysis, to write equations for linear DC and AC circuits and solve them using substitution and matrix methods. Also apply source transformation and source shifting techniques to solve circuit problems.

2. Use superposition theorem and ability to reduce more complicated circuits into the Thevenin's and Norton's equivalent circuits and solve for the required circuit variable. Also to analyze and design circuits for maximum power transfer.

3. Analyze series and parallel resonant circuits and understanding their applications. Also to compute initial conditions for current and voltage in first and second order RLC circuits.

4. Apply advanced mathematical methods such as Laplace transform and Fourier series for solving circuits problems.

5. Ability to represent two – port networks with different sets of two-port parameters and analyze them.

Syllabus:

Unit 1: Basic concepts

Introduction, Network terminologies, Review of KVL & KCL, Energy sources – ideal and practical, Source Transformations, Mesh Analysis of DC & AC circuits, Circuits with independent voltage sources only Mesh analysis – circuits containing independent current sources & dependent sources, Concept of super mesh, Nodal analysis - Circuits containing independent current sources, Nodal analysis – circuits containing dependent sources, Concept of super node, Star – Delta transformations & network reduction using them, Source Shifting , problems. **8 hrs**

Unit 2: Network Theorems

Superposition theorem, problems. Thevenin's theorem as applied to AC & DC circuits, Norton's theorem as applied to DC & AC circuits, Maximum power transfer theorem as applied to DC & AC circuits, Millman's theorem, applications & problems. **8 hrs**

UNIT 3: Resonance and Initial Conditions

Series resonance, resonant frequency, reactance curves, voltage & current variable with frequency, Selectivity & bandwidth, Q – factor, circuit magnification factor Selectivity with variable C & variable L Parallel resonance, resonant frequency, impedance, selectivity, bandwidth Maximum impedance conditions with C, L, & f variable, current & Q – factor.

Need, Initial conditions in R, L, & C elements. Final conditions and Geometrical interpretation of derivatives, Procedure to evaluate initial conditions. Initial state of a network. **8 hrs**

UNIT 4: Circuit Analysis using Laplace Transforms and Fourier series

Review of Laplace transforms, Natural & Forced responses, Advantages of LT techniques, Modeling R, L, & C in s – domain, DC transients, Step response of RC, RL & RLC circuits, Impulse & Pulse response of RC & RL circuits & AC transients, Circuit analysis with LT using partial fraction expansion & convolution integral.

Applications of Fourier techniques to circuit analysis, Waveform symmetry, Line spectrum, Waveform synthesis Effective value & power, problems, Application of FS in circuit Analysis.

8 hrs

UNIT 5: Network Functions and Two Port parameters

Concept of complex frequency, Network functions for one & two – port networks. Poles & zeros of network functions, Restrictions on pole & zero locations for driving point functions & transfer functions, Time domain behavior from pole – zero plots

Short – Circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, problems, Relationships between parameters, problems. **8 hrs**

Reference books:

1. M.E.Van Valkenburg: ***Network Analysis***, 3rd Ed, Pearson/ PHI, Reprint 2006.

2. Charles K Alexander, Mathew N O Sadiku: ***Fundamentals of Electric Circuits***, 3rd Ed Tata McGraw-Hill, 2008

3. D. Roy Choudhury: ***Networks and Systems***, New Age International, Reprint 2005.

4. J. David Irwin, R. Mark Nelms: ***Basic Engineering Circuit Analysis***, 10th edition, John Wiley &Sons, Reprint 2013

EC 320: Sensors and Actuators

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC320	**Sensors & actuators**	**3**	**1**	**0**	**4**	**50**	**50**	**100**

Course outcomes:

1. Understand the working principles of electrical and electronic measuring instruments.
2. Understand the construction features & working of CRO.
3. Understand the working principles of different transducers and finds its application.
4. Able to use different sensors & actuators in respective areas of application.
5. Understand the concept of Virtual Instrumentation and Data acquisition system.

Unit 1: Instrumentation system

Introduction, Input output configuration, Generalized functional elements, Advantages of electronic measurement, Errors in measurement, Gross errors and systematic errors, Absolute and relative errors, Static Characteristics, Dynamic Characteristics, calibration and standards-process of calibration. 8hrs

Unit 2: Oscilloscopes

Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch. Delayed time-base oscilloscopes, Sampling and Digital storage oscilloscopes. 8hrs

Unit 3: Transducers

Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive transducer, Capacitive transducers, Differential output transducers and LVDT. Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer. Temperature transducers. Basics of pressure measurement- Thin plate Diaphragms, Corrugated Diaphragms and Capsules, Bourdon tube elements, Ultrasonic sensors. 8hrs

Unit 4: Virtual Instrumentation

Introduction, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow. VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web. 8hrs

Unit 5: Actuators

Fuctional components of an actuator, Actuator as a system component, Intelligent & Self sensing actuators, piezoelectric actuators, microactuators, pressure sensors, flow sensors, position & rotary sensors. Application examples (Automatic anti lock breaking systems) 8hrs

Text Books:

1. Ernest .O. Doebelion, Dhanesh N Manik: ***Measurement Systems : Application & Design*** , 5th Ed, Tata McGraw-Hill, 2007
2. Dr.S.Sumathi, P.Surekha: ***LabVIEW based Advanced Instrumentation Systems***, Springer publication 2007.
3. D Patranabis: ***Sensors and Transducers*** 2nd Ed, PHI Ltd, 2003.

References:

1. H.S. Kalsi : ***Electronic Instrumentation***, 2nd Ed, Tata McGraw-Hill, 2008
2. Herman .K.P. Neubert : ***Instrument Transducers –An introduction to their performance and design***, 2nd Ed, Oxford University Press, 2003
3. Hartmut Janocha: ***Actuators Basics and Applications***, Springer publication 2013
4. D.V.S. Murthy: ***Transducers and Instrumentation***, 2nd Ed, PHI Ltd, 2010.

EC 330: Analog Electronic Circuits

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 330	**Analog Electronic circuits**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Model BJT using r_e and h models and analyze CE,CC and CB configurations using these models. Analyze cascaded systems, darlington and feedback pairs and current mirror and current sources
2. Develop FET small signal model and analyze and design CS,CG and CD configurations using this model . Analyze E-MOS and D-MOS amplifiers. Construction and working of amplifier circuits using JFET. Types of MOSFETs.
3. Model and analyze BJT and FET amplifiers at low and high frequencies. Apply Millers theorem at high frequencies and study the effect of cascading on frequency response.
4. Understand feedback concepts, effect of feedback and analyze various feedback topologies. Operation and perform the analysis of RC, LC and crystal oscillators.
5. Understand the classification of power amplifiers, their operation and ,analyze for efficiency and harmonic distortion. Understand the importance of heat sinking

Syllabus:

Unit 1: BJT AC analysis

BJT modeling, r_e model, hybrid model, hybrid π model, CE fixed bias, Voltage divider bias and emitter bias configurations, emitter follower, CB Configuration, cascaded systems Darlington connection, feedback pair, current mirror, current source. **10 hrs**

Unit 2: FET AC analysis

JFET Small Signal model, JFET Fixed bias, Self bias, Voltage divider bias configurations, source follower common gate configuration, design of FET amplifier, E-MOS and D-MOS amplifiers. **10 hrs**

Unit 3: BJT and FET Frequency response

General frequency considerations, low frequency response of BJT and FET amplifiers, Miller effect capacitance, High frequency response of BJT and FET amplifiers, multistage effects. **10 hrs**

Unit 4: Feed back and oscillators

Concept of feedback, feedback topologies, practical feedback circuits, basic principle of oscillators, RC, LC and crystal oscillators. **10 hrs**

Unit 5: Power amplifiers

Class A series fed and transformer coupled class A power amplifier, class B and class AB power amplifiers, Harmonic distortion, power transistor heat sinking, class C and class D power amplifiers. **10 hrs**

Text books:

1. ***Robert Boyelstad : Electronic Devices and circuit theory, 11th edition, Pearson, 2012***
2. ***Millman's Integrated Electronics, 2nd Edition, 2009, Jacob Millman,Christos Halkias, Chetan Parikh***

EC 340: Digital Electronic Circuits

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 340	**Digital Electronic Circuits**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Gain basic knowledge in digital fundamentals and various simplifying techniques of Boolean functions.
2. To analyze and design combinational circuits.
3. To design and implement the programmable logic circuits.
4. To gain comprehensive knowledge about the logic families and sequential circuits
5. Able to understand and solve the problems related to digital system.

Syllabus:

Unit 1

Simplification of Boolean expressions: Review of digital fundamentals, subsumes implicants, implicates prime implicants and EPI's. Introduction to K-maps basis for simplification. Four, five and six variables K-maps. Simplification procedure. Quine & McClussky method: Introduction .Decimal method of generation of PI's PI chart to generate EPI's .Map extend variables. Procedure for simplification

10 hours

Unit 2

Design of combinational logic circuits using MSI components and PLD's. Design of binary adders and subtractors. Carry look ahead adders: design principles. Decimal address and IC parallel adders. Comparators: a general n-bit comparator, Logic design using multiplexers and demultiplexers, Logic design using multiplexers and demultiplexers, Decoders, encoders and priority encoders ,Decoders, encoders and priority encoders **10 hours**

Unit 3

Logic design using PROMS, PALS & PLAS : Introduction to PLD's, terminology and notation ,PROMS: Principles & logic design using PROMS,PALS: Principles & logic design using PROMS,PLAS: Principles & logic design using PROMS,IC Logic Families: Digital IC terminology, V&I parameters, propagation delay ,Noise margin, speed power product, V-I characteristics Fan-in and Fan-out concepts ,TTL logic family circuit, characteristics ,Loading, Fan-out tri-state & open collector TTL **10 hours**

Unit 4

MOS logic family: characteristics, Open drain and tri-state outputs, CMOS bilateral switch, IC interfacing : Introduction, Different logic families : driving each other, Flip flops and their applications, SR latch switch de-bouncer gated latch, Master slave SR & JK flip flops, Edge triggered D flip flop and JK flip flop characteristic equations, Conversion of one flip flop to other type setup & hold times **10 hours**

Unit 5

Registers and counters, Design of binary ripple and synchronous counters of arbitrary modulo using different flip flop, Comparison of ripple and synchronous counters parallel carry & ripple carry, Shift registers of different kinds such as uni & bidirectional, universal shift registers, Sequential logic design: Introduction to mealy and moore models, State diagrams, excitations & transition tables, Derivation of switching functions and final logic diagram **10 hours**

Text Books:

1. Donald Givone: ***Digital principles & design*** TM-H-2003/2008
2. Morris Mano: **Digital logic and computer design** PHI/Pearson education-2010

EC 350: Engineering Electromagnetics

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 350	Engineering Electromagnetics	3	1	-	4	50	50	100

Course outcomes:

Upon completion of this course, student should be able to:

1. Understand fundamentals of vector calculus, different co ordinate systems, location of points, co-relate concept of gradient, divergence & curl with physical entities.
   a. Conceive the idea of charge as energy carriers. Computation of E Field & flux density due to various charge distributions using Coulomb's Law & Gauss law.
   b. Use mathematics of divergence to compute the total charges in a given volume.
2. Understand & compute work done by field & external agency, Potential due to charges & distributions, Evaluate energy density, relate charge to current & calculate current density. Solve problems on boundary conditions in field.
   a. Identify Poission's & Laplace fields & compute capacitance using Laplace equations.
3. Understand & solve problems related to static & time varying magnetic fields. Co relate the concept of curl to magnetic fields. Compute H field using Conventional & Ampere's law, Compute vector magnetic potential around a current source.
   a. Interpret sets of Maxwell's equations to both practical E & H fields & compute E & H field magnitudes using Maxwell's equations.

4. Understand the creation of EM waves using time varying E & H filed,& its mathematics. Generation of Uniform plane waves & computing power in wave using Poyinting's theorem.
6. Imagine progression of EM wave in 3 dimensions, to write simple codes to compute E & H fields using programme languages.

   Solve problems in all the three coordinate systems using basics of vector calculus.

Syllabus:

Unit 1:

Fundamentals of vector algebra & calculus ,Basic differential derivates of vector calculus. Co-ordinate systems & its components.

Electric charge, Coloumb's law, Electrical force, Electric field, electric Field Intensity, Field due to various charge distributions, Electric Flux & Flux density, Flux due to various charges distribution, gauss Law, Concept of Divergence. Computation of E filed using gauss law.

(8 Hrs)

Unit 2:

Work done in field, Line Integral concept, Potential, Potential due to various charge distributions, Conservative field .Potential gradient, due to dipole, types of dipoles, dipole as antenna. Energy density in Electrostatic field.

Concept of current & current density Equation of continuity, law of conservation of charges, Conductors & Di electrics, Boundary conditions, Capacitance in E field.

Poission's & Laplace fields, computation of volume charge density, Computation of capacitance using Laplace Equation (**12 Hrs)**

Unit 3:

Magnetic Field & its source. Properties of Magnetic field. Field computation using Biot-Savart's law. Concept of work done in magnetic field, Ampere's circuital law, Computation of H using ACL. Rotational field leading to curl. Mathematics of curl. Stoke's theorem. Magnetic flux density, Vector Magnetic potential. **(8 Hrs)**

Unit 4:

Introduction to Time varying fields. Faraday's equations. Various forces in Magnetic field. Concept of Displacement current density. Field relations for Time varying fields. Maxwell's equations for both static & time varying fields. **(6 Hrs)**

Unit 5:

Generation of Electro Magnetic waves, Mathematical equation of EM waves, properties of EM waves. Concept of Uniform Plane wave. Equation of UPW UPW in free space & various media. Power in EM waves. Poyinting's theorem. **(6 Hrs)**

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Reference books:

1. Engineering Electromagnetics: William H Hayt, Jr. 7th Edition, TMH
2. Electromagnetics with applications, 5th edition MC-Grawhill.

EC 31L: Analog Electronic Circuits lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 31L	**Analog Electronic Circuits lab**	**-**	**-**	**1.5**	**1.5**	**50**	**-**	**50**

Course outcomes:

1. Ability to read device data sheets and select parameters for the intended design.
2. Ability to design the circuit for the given specifications
3. Ability to practically evaluate the performance of designed circut ,compare with designed values and draw inferences.
4. Ability to obtain the frequency response/ response for various inputs/ transfer characteristic of the designed circuit and compare with the ideal ones

LAB EXPERIMENTS:

1.	Design and testing of BJT biasing circuits
2.	Design and testing of single stage RC coupled amplifier for given specifications.

3.	Design and testing of Emitter follower for given specifications.
4.	Design and testing of Darlington Emitter follower for given specifications
5.	Design and testing of FET CS amplifier for given specifications
6.	Design and testing of Current series feedback amplifier for given specifications
7.	Design and testing of Voltage shunt feedback amplifier for given specifications
8.	Design and testing of RC phase shift and Wein bridge oscillators.
9	Design and testing of LC oscillators.

EC 32L: Digital Electronic Circuits lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 32L	**Digital Electronic Circuits lab**	**-**	**-**	**1.5**	**1.5**	**50**	**-**	**50**

Course outcomes:

Upon completion of this course, student should be able to:

1. Simplification and analysis of Boolean expressions.
2. To analyze and design combinational and sequential circuits.
3. To design and implement the logic circuits using IC's and trainer kits.

List of Experiments

01		Simplification & realization of Boolean expressions(SOP,POS forms) using logic gates
02		Design of arithmetic circuits - adders & subtractors. 4-bit IC parallel adders. Complement arithmetic & decimal adders
03		Design of comparators & code converters
04		Logic design using multiplexers , decoders and demultiplexers
05		Design of seven segment display using decoders
06		Design of 3-bit synchronous & Asynchronous counters of arbitrary modulo UP, DOWN & UPDOWN using flip flops
07		Design of counters using IC versions(4-bit)
08		Design Shift registers using flip flops universal shift registers and shift register IC versions

IV SEMESTER

EC 410: Linear Integrated Circuits and Systems

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 410	**Linear Integrated Circuits and Systems**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Understand op-amp parameters, its internal block diagram and brief study of 741 op-amp. Analyze and design op-amp Direct-coupled voltage follower, inverting and non inverting amplifiers, Summing and difference amplifiers.
2. Analyze and design op-amp ac amplifiers and study their frequeny response.
3. Analyze and design IA, V to I and I to V converters, integrator and differentiator and data converter circuits. Analyze Precision half-wave and full-wave rectifiers, Clipping and Clamping circuits, Peak detectors, Sample and Hold circuits
4. Analyze and design Comparator and Schmitt trigger circuits, Square/Rectangular and Triangular wave generators, and Active Filters . Analyze LOG and ALOG amplifiers
5. Analyze and design voltage regulators and timing circuits using 555. Understand the operation of SMPS and PLL.

Syllabus:

Unit 1: Op-Amp Parameters and DC Amplifiers

Basic op-amp circuit, IC 741op-amp, Input/output impedances, Slew-rate & frequency limitations, Direct-coupled voltage followers, inverting and non inverting amplifiers, Summing and difference amplifiers. **10 hrs**

Unit 2: Op-Amp AC Amplifiers and Frequency Response

Capacitor-coupled voltage follower, non inverting and inverting amplifiers, High impedance amplifiers, use of a single polarity supply, Frequency and phase responses, Compensation methods, Slew-rate effects, Z_{in} Mod compensation, Circuit stability precautions. **10 hrs**

Unit 3: Op-Amp Linear Applications & Signal Processing

Instrumentation amplifier, V to I and I to V converters, integrator and differentiator, Precision half-wave and full-wave rectifiers, Clipping and Clamping circuits, Peak detectors, Sample and Hold circuits, A to D and D to A converters. **10 hrs**

Unit 4: Op-Amp Nonlinear Applications

Comparators, Schmitt trigger circuits, , Square/Rectangular and Triangular wave generators, Design of Active Filters, LOG and ALOG amplifiers. **10 hrs**

Unit 5: Voltage Regulators and 555Timer

Fixed and Adjustable voltage regulators, Switching regulators.555 Timer as Monostable and Astable multivibrators, applications. Introduction to Phase-locked loops (PLL). **10 hrs**

Reference books:

1. ***David A. Bell:*** *Operational Amplifiers and Linear ICs3rd Edition, Oxford university press,India, 2011*

2. ***Ramakanth A. Gayakwad:*** *Op-Amps and Linear Integrated Circuits, 4th Edition, Pearson Education Asia, Reprint 2011.*

3. ***D. Roy Choudhury, Shail B. Jain:*** *Linear Integrated Circuits, 3rd Edition, New Age International Publishers, New Delhi, 2013.*

EC 420: Switching Systems and Access Networks

Course code	Course title	Hours/week			Credits	CIE	SEE	Total
		L	T	P				
EC 420	**Switching Systems & Access Networks**	4	-	-	4	50	50	100

Course Outcomes:

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

1. Understand the working of telecommunication networks, working principle of four wire circuits, time division and frequency division multiplexing, digital hierarchy of networks and also SPC systems, call processing through DSS.
2. Able to analyse and solve models related to the traffic theory problems
3. Understand the importance of transmission standards and multiplexing hierarchies , convergent networks.,
4. Understand the concept and working of digital switching methods like Time division switching and space division switching and combination of switches. Understand the concepts and significance of technologies on access networks like DSL, Wi-Fi, Wi-Max, FTTH and HFC
5. Have a familiarization of generic issues related to DSS software and hardware architecture, classification of DSS software, network and operational aspects..

Syllabus:

UNIT 1:

Developments of telecommunications: Network structure, Network services, terminology, Regulation, Standards. Introduction to telecommunications transmission, Power levels, Four wire circuits, Digital transmission, FDM, TDM ,PDH and SDH, Transmission performance.

10hours

UNIT 2:

Evolution of Switching Systems: Introduction, Message switching, Circuit switching, Functions of switching systems, Distribution systems,

Digital Switching Systems: Fundamentals : Purpose of analysis, Basic central office linkages, Switching system hierarchy, Evolution of digital switching systems, Stored program control switching systems, Digital switching system fundamentals, Building blocks of a digital switching system, PCM, digital transmission systems, Basic call processing. **10hours**

UNIT 3:

Telecommunications Traffic: Introduction, Unit of traffic, Congestion, Traffic measurement, Mathematical model, Lost call systems, Queuing systems. **10 hours**

UNIT 4:

Time Division Switching: Introduction, space and time switching, Time switching networks, Synchronization. Access networks: Local loop, ADSL, XDSL, WILL, Wi-fi, Wi-Max, FTTH, HFC. Introduction to Stored program control switches. **10 hours**

Unit 5:

Switching System Software: Introduction, Scope, Basic software architecture, Operating systems, Database Management, Concept of generic program, Software architecture for level 1 control, Software architecture for level 2 control, Software architecture for level 3 control, Data structures for SPC software, Network and operational aspects., Common channel signalling

10 hours

References:

1. J E Flood: Telecommunication and Switching, Traffic and Networks, Pearson Education, Reprint 2002

2. Syed R. Ali, Digital Switching Systems – Reliability and analysis, Tata McGraw-Hill, 2002.

3. **John C Bellamy**: Digital Telephony, 3rd Edition, Wiley India, 2000

4. **F J Redmill and A R Valdar**: SPC digital telephone exchanges, Peter Perigrinus Ltd IEE telecom series 21, ,ISBN 0 86341 301 3

EC 430: Signals and Systems

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC430	**Signals and Systems**	**3**	**1**	**0**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Identify and classify signals as continuous/discrete, energy/power, periodic/ nonperiodic etc., and and systems as linear/nonlinear, causal/noncausal, time-invariant/time-variant etc.
2. Represent LTI systems using impulse responses, differential/ difference equations and block diagrams and determining system responses in the time-domain using them.
3. Find the Fourier series /Fourier transform representations for continuous- time signals and systems and use them in signal/system analysis, characterization, and manipulation.
4. Find the Fourier series /Fourier transform representations for discrete-time signals and systems and use them in signal/system analysis, characterization, and manipulation.
5. Find z-transform representations for discrete-time signals and systems and use Z-transforms to obtain transfer function and response of causal LTI systems.

Syllabus:

Unit 1: Basics of Signals and Systems

Introduction, Definitions and examples of a signal and a system, Classification of signals, Basic operations on signals, Elementary signals, Systems viewed as interconnection of operations, properties of systems. **8 hrs**

Unit 2: Time Domain Representation of LTI systems

Introduction, Impulse response characterization and convolution sum for the discrete time LTI systems, Properties of convolution sum, Impulse response characterization and convolution integral for continuous time LTI systems, properties of convolution integral, Interconnection of LTI systems, LTI system properties in terms of impulse response, Step response, Differential and

Difference equation representation of LTI systems, Characterization of Systems described by differential or difference equations, Block diagram representation. **8 hrs**

Unit 3: Fourier analysis of Continuous time signals and LTI systems

Introduction, Complex sinusoids and frequency response of LTI systems, Fourier representation for four classes of signals, Fourier series representation of Continuous time periodic signals(CTFS), Convergence of Fourier Series , Properties of Amplitude and Phase spectra, Continuous time Fourier transform (CTFT), properties, Magnitude and Phase spectra, Frequency response of continuous time LTI systems, application of Fourier transform, relating FT to FS, Relationship between LT and FT. **8 hrs**

Unit 4: Fourier analysis of discrete time signals and LTI systems

Fourier representation of Periodic signals in discrete time (DTFS), Properties, Discrete time Fourier transform(DTFT), properties and applications of DTFT, Relating the FT to the DTFT, Relating the FT to the DTFS, Sampling and Reconstruction **7 hrs**

Unit 5: z- transforms and Applications

Introduction to z-transform, ROC and its properties, properties of z- transform, Inverse z-transform, Analysis and characterization of LTI systems using z-transforms, Computational structures for implementing Discrete time LTI systems, Unilateral

z-transforms and their applications for solving difference equations, Relationship between z- , Laplace and DTFTs. **9 hrs**

Reference Books:

1. Simon Haykin and Barry Van Veen **,** ***Signals and systems*** – Wiley India Edition, Second edition, 2008.
2. Alan V Oppenheim, Alan S Wilsky**,** S Hamid Nawab: ***Signals and system*** 2nd edition , PHI/Pearson Education, 2004.
3. T P Hsu**,** ***Signals and systems***- Tata McGraw Hill, 2006.

EC 440: Digital System Design

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 440	**Digital System Design**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Gain basic knowledge in arithmetical operations, numeric data representation and data transfer operation.
2. To analyze and design simple computing systems.
3. To design and implement the complex control design.
4. To gain comprehensive knowledge about the complete microprocessor design.
5. To be able to understand and solve memory and peripheral interfacing problems

Syllabus:

UNIT 1:

Introduction: Inter Register Transfer Arithmetic. Logic and Shift Micro operations. Conditional control statement Fixed point Binary Data Overflow. Arithmetic Shift Decimal data. Floating point data and Non numeric data. Instruction codes Macro Vs Micro Operations. **.** **10 hours**

UNIT 2:

Design of a simple computing system. Processor logic Design : Introduction processor organization, ALU design of Arithmetic circuits. Design of logic units. Design of A and L unit, Status Register. Design of Shifters. Processor unit. Design of Accumulator**.** **10 hours**

UNIT 3:

Control organization: one flip-flop PG state method. PLA control and micro program control. Hard wired control. Micro program control. PLA control. Micro program Sequences .Micro programmed CPU organization. Complete design fundamentals: Introduction system configurations. Computer Instructions Execution of Instructions **10 hours**

UNIT 4:

Design of registers. Microcomputer system design: Introduction Organisation. Microprocessor organization. Block schematic. Memory cycle. Instruction and addressing modes. Stack, subroutines and Interrupt Memory Oraganisation. . **10 hours**

UNIT 5:

I/O interface parallel peripheral Interface. Serial communication interface . DMA and DMA transfer in microcomputer system Role of cache memory. Data hazards. Introduction hazards. Conditional and un conditional hazards **.** **10 hours**

Text Books:

1. Morris Mano**:** ***Digital Logic and Computer Design***. Pearson Education, 2010

2. Carl Hamacher, Zvonko Vranesic, and Safwat Zaky: ***Computer Organization***, Fifth Edition, McGraw-Hill, 2008

EC 450: Channel Theory

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 450	**Channel Theory**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Pre Requisites: KVL, KCL, Maximum power transfer theorem, Maxwell's equations(Rectangular and cylindrical coordinate systems), Partial differential equations & Bessel functions.

Course Outcomes: After studying this unit student will be able to:

1. Understand different types of lines, concept of distributed parameters, distinguish distortions and losses in lines.
2. Explain signal propagation at RF in transmission lines, understand Smith chart principles and apply the same in problem solving.
3. Distinguish different types of strip lines and quantify their different losses.
4. Signal propagation in wave guides& fibers, determine information capacity based on pulse broadening in fibers.
5. Classify different noise sources in communication channels, model them and study effect of interference on communication**.**

Unit 1: Line at LF

Transmission lines at low frequencies, Types, distributed parameters, transmission line equation and solutions, Line constants, input impedance, infinite lines, distortion less lines and conditions, reflections, open circuit and short circuit lines, reflection co efficient, t and pi equivalent circuits, reflection and insertion loss 10 hours

Unit 2: Line at RF

Introduction, line constants, SWR, Relationship between SWR and reflection coefficient, Power measurements, loss less lines as impedance matching sections, stub matching, OC and SC lines, Smith chart principles and applications

12 hours

Unit 3: Strip lines

Micro strip lines, parallel strip lines, co-planar strip lines, shielded strip lines, losses in strip lines, strip line parameters

8 hours

Unit 4: Wave guides and Optical fibers

Introduction to waveguides, Rectangular and circular waveguides, Modal theory- TE and TM waves, Impossibility of TEM waves, Waveguide parameters, directional coupler, introduction to fibers, Pulse broadening in fibers, information capacity, Optical and electrical bandwidth, Single mode fibers, ISI, information capacity

10 hours

Unit 5: Wireless channels

Noise and interference in Communication Channels: Internal noise, external noise, noise modeling, frequency (orthogonal) domain representation, carrier to noise ratio, probability error, Gaussian noise (white noise) representation. Power spectral density of Noise, Fading of signals, long term, short term fading and Rayleigh fading.

10 hours

Text Books:

1. **John D Ryder**: Fields lines and waves , PHI, 2ed
2. **Gerd Keiser**, "Optical Fiber Communication”, 4th Ed., MGH, 2010.
3. **Taub and Schiling**: Communication Systems McGraw Hill 4th Edition

References:

4. **Joseph C Palais**: Fiber optic communication, 3rd Edition Pearson
5. **Samuel .Y.Liao :** Microwave devices and circuits, 3ed, 2009 , Prentice Hall

EC 41L: Linear Integrated Circuits Lab

EC41L: Linear Integrated Circuits Laboratory **0:0:1.5**

Course outcomes:

1. Ability to read device data sheets and select parameters for the intended design.

2. Ability to design the circuit for the given specifications

3. Ability to practically evaluate the performance of designed circut ,compare with designed values and draw inferences.

4 .Ability to obtain the frequency response/ response for various inputs/ transfer characteristic of the designed circuit and compare with the ideal ones

LAB EXPERIMENTS:

01. Design and testing of op-amp DC amplifiers:Inverting amplifier, Non- inverting amplifier and voltage follower
02.Design and testing of op-amp DC circuits: Adder, subtractor, Difference amplifier, Averager
03. Design and testing of op-amp AC amplifiers: Inverting amplifier, Non- inverting amplifier and voltage follower
04 Design and testing of op-amp integrator
05 Design and testing of op-amp differentiator
06 Study of Precision Rectifiers and V to I converter
07 Design and testing of Schmitt Trigger Circuits
08 Design and testing of Op -Amp Triangular and Rectangular Waveform Generators
09 Design and testing of voltage regulator
10 Design and testing of 555 Timer Astable Multivibrator

EC 42L: Digital System Design lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 42L	Digital System Design lab	-	-	1.5	1.5	50	-	50

Course outcomes:

Upon completion of this course, student should be able to:

6. Knowledge about Verilog HDL and programming digital circuits using Verilog HDL.
7. To design and simulate using Integrated Software Environment.
8. To design and implement the digital system using programmable devices.

List of Experiments (Programming using Verilog HDL)

1. **Combinational Circuits simulation using XILINX ISE**

   Decoders/Encoders, Mux / Demux, Magnitude comparator, Parity generator & checker Adder/ Subtractor , Parallel adder, BCD adder, Ripple carry adder

2. **Sequential circuit's simulation using XILINX ISE**

   Latches, Flip-flops, Counters, Shift Registers and simulation of the examples worked out in the theory classes

3. **Implementation of digital circuits using CPLD/FPGA**

   ALU, Traffic light controller

4. **Mini Project**

V SEMESTER

EC 510: Analog Communication Systems

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 510	Analog Communication Systems	4	-	-	4	50	50	100

Course Outcomes:

Upon completion of this course, student should be able to:

1. Discuss the different types of noise exists in communication systems and power measurement units.
2. Understand the operations of PLL, Frequency synthesizers and phase discriminators circuits.
3. Design and Construction of the AM modulation and detection.
4. Design and Construction of the DSBSC and SSBSC modulation and detection.
5. Understand the fundamental concepts of narrow-band and wide-band FM generation and detection.

Syllabus:

Unit 1: Introduction to electronic communication systems

Introduction to electronic communication systems, Power measurement units, EM frequency spectrum, Bandwidth and information capacity, Noise analysis, Signal analysis and mixing, power spectra. **10 hrs**

Unit 2: Phase lock loops and Frequency Synthesizers

Phase lock loops. PLL capture and lock ranges, PLL loop gain, Phase comparators, frequency synthesizers and Digital PLL. **10hrs**

Unit 3: **AM transmission and Reception**

Introduction, principles of Amplitude modulation, AM modulating circuits, AM Transmitters, AM receivers, AM receiver circuits, QAM. **10hrs**

Unit 4: Single sideband communication systems

SSB Generation, SSB transmitters, Mathematical analysis of Suppressed carrier systems, SSB reception. Single side band and suppressed carrier and FDM and SSB measurements. **10 hrs**

Unit 5: **Angle Modulation Transmission and reception**

Angle modulation systems, Mathematical analysis, Deviation sensitivity, Demodulators, Frequency analysis of angle modulated systems, bandwidth requirements, Commercial FM broadcast, noise and angle modulation, FM transmitters, Reception and FM Stereo, Linear integrated FM receivers, two way mobile communication services, two way FM communications. **10 hrs**

Text books:

1. Wayne Tomasi : ***Electronic Communication Systems,*** 5th edition, Pearson Education, 2007
2. B P Lathi and Zni Ding: Modern analog and Digital communication Systems: OUP, IV edition
3. Simon Haykins: ***Communication Systems***, 5th Edition, John Wiley, 2009.

Reference books:

1. Michael Fitz: ***Fundamentals of Communication Systems***, TMH, 2008 (for MATLAB exercises and mini projects)

2. Singh and Sapre*:* ***Communication Systems, Analog and digital*** . TMH 2nd , Ed 2007.

3. B. P. Lathi**:** ***Modern digital and analog Communication systems***, Oxford University Press., 4th ed, 2010,

EC520: Digital Signal Processing

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 520	**Digital Signal Processing**	**3**	**1**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Understand representation of discrete-time signals in the frequency domain, using discrete Fourier transform (DFT).
2. Know about different methods for computing DFT and IDFT.
3. Learn about different methods of designing IIR filters for the given specifications.
4. Learn to design FIR filters using windowing and frequency sampling technique.
5. Understand different methods of realizing digital filters, become aware of some applications of digital signal processing, short term Fourier transform and wavelet transform and digital signal processors.

Unit 1: DFT, Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms. Properties of DFT. Use of DFT in linear filtering. Direct computation of DFT. **08 hours**

Unit 2: DIT and DIF algorithms for computing DFT and IDFT. Goertzel algorithm, Chirp-Z Transform. **08 hours**

Unit 3: IIR filter design: Introduction to IIR filters, characteristics of commonly used analog filters, frequency transformations, and design of IIR filters from analog filters using IIT and BLT techniques. **08 hours**

Unit 4: FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing and frequency sampling techniques. **08 hours**

Unit 5: Implementation of discrete time systems: Direct form-I, direct form-II, Transposed, cascade, parallel and lattice realizations of FIR and IIR filters. Quantization of filter coefficients, Round-off effects in digital filters. **04 hours**

Introduction to STFT and wavelet transforms. Recent developments and applications of signal processing, Digital Signal Processors. **04 hours**

References:

1. Proakis and Manolakis, "***Digital signal processing – principles , Algorithms and applications***", Pearson Education, 4th Edition, 2007
2. Oppenheim and Schaffer, "***Discrete time signal processing***", PHI , 2003
3. S.K. Mitra, "***Digital signal Processing***", TMH, 2004
4. IEEE Transactions on Signal Processing.

EC530: MICROPROCESSOR SYSTEMS

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC530	**Microprocessor systems**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

After the completion of course the student will be able to

1. Know the architecture of 8086 processor and instruction set .
2. Know to write assembly language programming of 8086.
3. To understand minimum mode and maximum mode configuration of 8086 processor and interfacing of I/O devices to 8086 processor.
4. Know interrupt structure of 8086 processor and develop applications based on interrupts.
5. Know architecture and instruction set of 80386 and 80486 processor and learn the features of Pentium and Pentium pro processors.

Syllabus:

UNIT 1: Introduction to 8086 microprocessor:- Architecture of 8086, Register organization, Physical memory organization, addressing modes, instruction set. 10 hrs

UNIT 2: **8086 assembly language programming**:- Programming using data transfer instructions, arithmetic and logical instructions, conditional and unconditional branch instructions, String instructions, Looping instructions, Machine control instructions, Shift and rotate instructions, assembler directives, macros and procedures. 10 hrs

UNIT 3: 8086 configurations:-Minimum mode and maximum mode configuration, Interfacing memory and i/o devices, interfacing of keyboard, LEDS, Stepper motor, ADC DAC to 8086 using 8255 in mode 0 configuration, bus architecture. 10 hrs

Unit 4:- 8086 interrupts: -8086 interrupts and interrupt responses, hardware interrupts, software interrupts, its applications.DMA: Basic DMA operation.DMA controlled I/O. 10 hrs

UNIT 5:- Introduction to advanced processors:- Introduction to 80386 processor, Special 80386 registers, 80386 memory management, introduction to 80486 microprocessor, Introduction to Pentium Processor, Special Pentium Registers, Pentium memory management, Introduction to Pentium Pro microprocessors. Special Pentium Pro features. 10hrs

References:

1. Y C Liu and Gibson :-"***Microcontroller Systems-The 8086/8088 family***-"–PHI 2003
2. Barry B Brey :-"***The Intel Microprocessor, Architecture, Programming, and interfacing***"- 8 ed. PEARSON EDUCATION
3. James L Antonakos:-" ***The Pentium Microprocessor***" -Pearson education
4. Douglas V Hall:-" ***Microprocessor an Interfacing- Programming and Hardware***" – 2ed PEARSON EDUCATION
5. A K Ray and K M BhurchandI :-"***Advanced Microprocessors and Peripherals***"- TMH 2001

EC540: CONTROL SYSTEMS

Course code	Course title	Hours/week L	T	P	Credits	CIE Marks	SEE Marks	Total Marks
EC 540	**Control Systems**	**3**	**1**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Model various physical systems as transfer function. Also will be able to find the transfer function when there is inter connection of several sub-systems.
2. Perform stability, time domain and frequency domain analysis of systems using appropriate tools.
3. Design PI, PD, PID controllers and phase-lead compensator.
4. Model, analyze and control using modern technique of state-space.
5. Analyze, design and verify control systems using MATLAB/SIMULINK.

Syllabus:

Unit 1:

Concept of feedback control, Laplace transform review, Examples of control systems (Electrical, mechanical, electromechanical) and their mathematical models with transfer function and State-space models. Block diagram representation and its algebra, Signal flow graphs and Mason's gain formula. **8 hrs**

Unit 2:

Time domain analysis, Effect of pole-zero location and addition, step response and impulse response of the standard first and second order systems, Stability w.r.t. transfer function, Routh-Hurwitz method, Steady state error analysis of Type-0,1,2 systems, Classical PID controller, .

8 hrs

Unit 3:

Root-locus of a basic feedback system and guidelines, Control design using RL technique, frequency response, Nyquist stability criterion, stability margins, closed-loop frequency response, Phase lead compensation and its design. **9 hrs**

Unit 4:

State-space design and its advantages, analysis of state-equations, Canonical structures, full-state feedback control, Controllability, Observability, selection of pole locations for good design, estimator design, combined control law and estimator. **9 hrs**

Unit 5:

Case studies: An outline of control systems design, satellite's attitude control, Maglev control, Read-write head assembly of hard disk. **6 hrs**

Text books:

1. Franklin, Powell & Naeini, ***Feedback Control of Dynamic Systems*** by Pearson India, 5th Edition (2008)
2. M. Gopal, ***Control Systems : Principles & Design*** by Tata McGraw Hill, Fourth Edition, (2012)

Reference books:

1. K. Ogata , ***Modern Control Engineering***, PHI Publications, (2010)
2. Norman Nise, ***Control Systems Engineering,*** Wiley India, 6th Edition (2012)

EC 550: Microwave and Antennas

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 550	Microwave and Antennas	4	-	-	4	50	50	100

Pre Requisites: KVL, KCL, Maximum power transfer theorem, Maxwell's equations (Rectangular and cylindrical coordinate systems), Partial differential equations & Bessel Functions & vector algebra.

Course Outcomes: After studying this unit student will be able to:

1. Identify different microwave frequency bands, understand radiation hazards and explain the operation few micro wave devices. Determine S parameters of few Two port N/Ws. Design simple micro strip filters
2. Explain different terminologies associated with satellite communication and application of satellites in mobile communications.
3. Understand basic Radiometry , TV & HDTV principles.

4. Derive radar range equation, explain Doppler principle, few types of radars and scanning principles.
5. Define different antenna parameters, explain different types of antennas and design an antenna.

Unit 1: Introduction to microwaves and devices

Introduction , bands , advantages , application and radiation hazards , S parameters, microwave filters , klystron , magnetron & TWT , Gunn diode , Tunnel diode, varactor diode , IMPATT and TRAPATT diodes.(One Vacuum tube and one Solid state device is to be covered) Introduction to MIC, materials, MOSFET fabrication, thin film components, hybrid circuits **12 hours**

Unit 2: **Satellite communication**

Introduction, basic definitions, satellite orbits, earth station, satellite transponder, link equations, satellites for mobile applications. 8 hours

Unit 3: Radiometry and TV

Radiometry principles, Introduction to TV standards, scanning principles, composite video, VSB transmission, color transmission, HDTV principles. 10 hours

Unit 4: Radar systems

Radar system principles, Unambiguous range equations, pulse radar, CW and FM Radar, MTI principles, MTI Radar, Pulse Doppler Radar, Scanning and Tracking, Radar displays and Radar beacons. 10 hours

Unit 5: **Antennas**

Antenna basics, field pattern, linear dipole antenna, slot antenna, helical antennas, reflector antennas , antennas for base stations, antennas for mobile units, special purpose antennas, antennas for ground penetrating radars, Micro strip antennas, patch antennas and intelligent antennas. 10 hours

SLE component: Advanced topics from papers and journals (One compulsory question to be set in the SEE paper)

Text Books:

1. **Annapoorna Das ;** Microwave Engineering , TMH, 2ed, 2009.

2. **Samuel .Y.Liao :** Microwave devices and circuits, 3ed, 2009 , Prentice Hall

3. **Kennedy :** Communication Systems, McGraw Hill, 5th ed,2009

References:

4. **M I Skolnik :** Introduction to Radar, McGrawHill, 4th ed., 2004

5. **J.DKraus:** Antennas for all applications, 4ed, McGrawHill , 2012

6. **Dennis Roddy,** Satellite communication, Mc Graw-Hill, 4th ed, 2006

EC 560: Data Structures and Algorithms

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC560	**Data Structures and Algorithms**	**3**	**-**	**1**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Understand basic techniques of algorithm analysis
2. Able to Design Algorithms, to solve real life problems using tools introduced.
3. To analyze solution for the correctness.
4. Efficiently implement solutions.
5. Demonstrate analytical comprehension of concepts such as abstract data type, programming technique and algorithm

Syllabus:

Problem Solving using Computers - Abstraction - Abstract data types; Data Representation; Elementary data types; Basic concepts of data Structures; Mathematical preliminaries - big-Oh notation; efficiency of algorithms; notion of time and space complexity; performance measures for data structures.

ADT array - Computations on arrays - sorting and searching algorithms.

ADT Stack, Queue, list - array, linked list, cursor based implementations of linear structures.

ADT Tree - tree representation, traversal of trees;

ADT Binary tree - binary trees, threaded binary trees, application of binary trees - Huffmann coding; application of threaded binary trees - differentiation;

Search Tree - Binary search tree; balanced binary search trees - AVL tree; Applications of Search Trees - TRIE; 2-3 tree, 2-3-4 tree; concept of B-Tree.

ADT Dictionary - array based and tree based implementations; hashing - definition and application - LZW encoding.

ADT Priority Queue - Heaps; heap-based implementations; applications of heaps - sorting;

Graphs - shortest path, minimum spanning tree, DFS, BFS - an application of DFS and BFS.

Algorithm Design Paradigms - greedy, divide and conquer, dynamic programming, backtracking.

References:

1. Aaron M. Tenenbaum, ***"Data structures using C and C++" 2nd Edition, PHI***
2. Adam Drozdek, ***"Data Structures and Algorithms in C++", Brooks and Cole, 2001.***
3. Booch, Jacobson***, "Object Oriented Analysis and Design with Application", Pearson Education.***
4. Sartaj Sahni, ***"Data structures, Algorithm and Application in C++", McGraw Hill.2000***

EC 51L: Microcontroller Lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC52L	Microcontroller lab	-	-	1.5	1.5			50

Course outcomes:

After the completion of course the student will be able to

1. Know about architecture of of 8086 processor.
2. Know about data transfer instruction set and write programs based on these instructions.
3. Know about arithmetic, logical and branch instructions and write programs based on these instructions.
4. Write programs based on array handling, strings and interrupts.
5. Interface some application and write program for these applications.

Syllabus:

Software programs**:**

Programs involving

1) Data transfer instructions
2) Arithmetic & logical operations
3) Bit manipulation instructions
4) Branch/Loop instructions
5) Arrays
6) Near and Far Conditional and Unconditional jumps, Calls and Returns
7) Programs on String manipulation
6) Programs involving Software interrupts (DOS interrupt INT 21h Function calls)

Hardware programs:

a) Matrix keyboard interfacing

b) Seven segment display interface

c) Logical controller interface

d) Stepper motor interface and DC motor interface

e) ADC interface

f) DAC interface

g) elevator interface

h) LCD interface

EC 52L: Analog Communication Lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 52L	**Analog Communication Lab**	**-**	**-**	**3**	**1.5**	**50**	**-**	**50**

Course outcomes:

After completing this lab, the student will be able to:

1. Understand the concept of modulation.
2. Distinguish analog and pulse modulation.
3. Test and quantify the characteristics of modulators and demodulators.
4. Design and test few attenuators for specific attenuation.
5. Set up an analog communication link.

1. Analog modulation and demodulation(Discrete/Kits): a)AM b)FM

2. Pulse modulation and demodulation (Discrete/Kits):

a)PAM b)PWM c)PPM d)PCM

3. Attenuators (Design using discrete components):

a) T b) PI c) Lattice d) Bridge

4. Class-C tuned amplifier

5. Mixer circuit, tone decoder & Video amplifier

6. Mini projects

Reference Books:

1. **Simon Haykin, " Communication systems",** Wiley, 5th ed, 2009,
2. **Kennedy : "Communication Systems**", McGraw Hill, 5th ed,2009
3. **Dennis Roddy and John Coolen, "Communication systems",** Mc GrawHill, 4th ed, 2008

EC 53L: DSP LABORATORY

Course code	Course title	Hours/week L	T	P	Credits	CIE Marks
EC52L	**DSP**	**0**	**0**	**1.5**	**1.5**	**50**

LIST OF EXPERIMENTS

1. Write a MATLAB code to implement the Nyquist sampling theorem. The program should illustrate the effects the sampling the signal at

   a) Exactly the folding frequency

   b) Frequency less than the folding frequency

   c) Frequency greater than the folding frequency

   Plot the magnitude spectrum for all the above said cases.

2. Write a MATLAB code to implement the DTFT and DFT of a sequence x (n). Also plot the magnitude spectrum of both DTFT and DFT and provide the inference on the basis of results obtained. Further compute the IDTFT and IDFT.
3. Write a MATLAB code to verify the following properties of DFT
    a. Linearity
    b. Periodicity
    c. Circular shift and Circular symmetry of a sequence
    d. Symmetry property
    e. Circular convolution and multiplication of two sequences
    f. Time reversal of a sequence
    g. Circular time shift and Circular frequency shift of a sequence
    h. Parseval's theorem
4. Write a MATLAB code to implement the DFT of a sequence x (n) using DIT and DIF algorithm. Also indicate the speed improvement factor in calculating the DFT of a sequence using direct computation and FFT algorithm (Use the same sequence as used in Program 2). Further compute the IDFT using IDIT and IDIF algorithm.
5. Write a MATLAB code to implement the Low pass and High Pass FIR linear phase filter using Hamming and Hanning windows (with inbuilt and without using inbuilt commands). Plot the magnitude and phase response. Also, Provide the inference on the basis of results obtained for the set of specifications. (To design should be verified by convolving the input signal with the designed filter co-efficients)
6. Write a MATLAB code to implement the Band pass and Band reject FIR linear phase filter using Hamming and Hanning windows (with inbuilt and without using inbuilt commands). Plot the magnitude and phase response. Also, Provide the inference on the basis of results obtained for the set of specifications.
7. Write a MATLAB code to implement the Low pass Butterworth IIR filter using bilinear transformation (BLT) method and Impulse Invariant Technique (IIT) method.
8. Write a MATLAB code to implement the Low pass Chebyshev (Type 1) IIR filter using bilinear transformation (BLT) method and Impulse Invariant Technique (IIT) method.

9. Write a MATLAB code to illustrate the effect of Decimation and Interpolation by an integer factor. Plot the magnitude spectrum. Design the necessary filter to overcome aliasing and image frequencies after decimating and interpolating the signal respectively.
10. Write a MATLAB code to illustrate the effect of sampling rate conversion by a non-integer factor. Plot the magnitude spectrum. Design the necessary filter to overcome aliasing and image frequencies.
11. Consider a noisy audio signal that is corrupted with the 60Hz noise component. Write a MATLAB code to remove this 60Hz noise component from the signal using Notch filter and LMS adaptive filter. Plot the magnitude spectrum of the signal filtered using both Notch filter and LMS adaptive filter and provide the inference on the basis of results obtained.
12. Compute the linear and circular convolution of two sequences using CCS V5.3 simulator and using TMS6713 DSP processor. Plot the resultant signal.
13. Compute the N point DFT of a given sequence and plot the spectrum.
14. Realization of an FIR filter (any type) on TMS6713 to meet given specification. The input can be a signal from function generator/Audio signal. Filtered signal to be viewed on CRO.

TEXT BOOKS

1. Proakis, Manolokis, Vinay Ingle, ***Digital Signal Processing***, Pearson India, 4th Ed, 2007.
2. Robert A. Schilling, Sandra L. Harris, ***Introduction to Digital Signal Processing using MATLAB***, 2013.
3. Rulph Chassaing, Donald Reay, ***Digital Signal Processing and Applications with C6713 and C6416 DSK***, Wiley 2nd Edition, 2008.

VI SEMESTER

EC 610: Computer Networks

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 610	**Computer Networks**	**4**	**0**	**0**	**4**	**50**	**50**	**100**

Course outcomes:

1. To provide insight about networks, topologies, and the basic concepts
2. To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities
3. To understand the principles, protocols, design issues, and significance of each layers in ISO and TCP/IP
4. To analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
5. To familiarize the participants with the recent advances in the networking and Telecommunication Technologies
6. Knowledge of basic network theory and layered communication architectures
7. Ability to solve problems in networking

Syllabus:

Unit 1:

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Telephone and cable networks for data transmission, Dial-Up Modems, DSL

Data link control: Framing, Flow and error control, Protocols for Noiseless channels and noisy channels, PPP, HDLC. **10 hours**

Unit 2:

Multiple Accesses: Random access, Controlled access, Channelization Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11 **10 hours**

Unit 3:

Network Layer, Logical addressing, IPv4 addresses, IPv6 addresses, Address allocation, NAT, IPv4 and IPv6 Datagram formats, Inter-networking, Transition from IPv4 to IPv6 **10 hours**

Unit 4:

Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols **10 hours**

Unit 5:

Transport layer: Process to process Delivery, UDP, TCP, Domain Name System(DNS), Resolution **10 hours**

References:

1. **B Forouzan:** Data communication and networking 5th Ed TMH 2012
2. **B Forouzan:** TCP/IP Protocol suite 4th Edition, TMH 2010
3. **James F. Kurose, Keith W. Ross**: Computer networks, Pearson education, 5th Edition, 2010
4. **Wayne Tomasi**: Introduction to Data communication and networking , Pearson education 2007

Lab Activities:

Experiments based on CISCO Packet Tracer for network configurations; Network addressing, Subnetting and super netting, Routing protocols, and Router configurations

VLANs, wireless LANs, Programming exercises on networking algorithms

Subnetting experiments on Qualnet software

EC 620: Power Electronics

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 620	Power Electronics	3	0	1	4	50	50	100

Course Outcomes:

On successful completion of the course, the students will be able to:

1. Explain basic operation of various power semiconductor devices and analyze their characteristics and identify the suitable device for the given application.
2. Understand basic operation of firing and protection circuits and design suitable protection and control circuits for different power switching devices.
3. Describe basic operation of controlled rectifiers and AC voltage controllers with different types of load and determine their performance parameters
4. Describe working principle of DC-DC converters with different types of load and explain different methods of chopper control and design DC-DC converters for industries, electric traction and non-conventional energy applications.
5. Explain the working principle of inverters and describe different methods of voltage control for the same and design inverters for industries, commercial and non-conventional energy applications. Study and design of commercial power supplies

Syllabus:

Unit 1: Power Semiconductor Devices

Introduction to Power Electronics. Power Diodes- Types, rating and switching characteristics. Current controlled devices: BJTs and Thyristors – Construction, operation, switching characteristics, rating and types. Voltage controlled devices: Power MOSFETs and IGBTs – construction, operation, switching characteristics, rating and types. Principles of series and parallel operation of power switching devices. Different types of Power Electronic circuits.

8 hrs

Unit 2: Firing and Protection Circuits

Firing circuits for power electronic devices, Gate driver circuits for SCR, MOSFET and IGBT and base driving for power BJT, Over voltage, over current and gate protections, Necessity of isolation, pulse transformer, optocoupler , Design of snubbers. **7hrs**

Unit 3: Controlled Rectifiers

Introduction, Performance of Single phase fully controlled and semi controlled converters with R and RL Loads for continuous and discontinuous current modes. AC Voltage Controllers: - Introduction, On-Off and Phase control, Single - phase Bidirectional controllers with resistive and inductive loads **8 hrs**

Unit 4: DC – DC Converters or Choppers

Introduction, principle of operation, analysis of Buck, Boost, and Buck-boost converters, operation with R and RL loads, and their control strategies, performance parameters and classification. **8 hrs**

Unit 5: Inverters

Introduction, principle of operation, performance parameters, and control strategies of Single phase Full and Half Bridge inverters with R and RL Loads, Introduction to Three phase, Current source inverters, Power Supplies: UPS, SMPS **9hrs**

Power Electronics Laboratory Experiments:

1. Analysis of static and dynamic characteristics of MOSFET and IGBT.
2. Analysis of static and dynamic characteristics of Power Transistor and SCR.
3. Performance analysis of Controlled HWR and FWR using RC triggering/ UJT firing circuit.
4. Performance of Single phase fully controlled and semi controlled converters for R and RL loads for continuous current mode.
5. Performance analysis of AC voltage controller using Triac- Diac combination.
6. Performance analysis of Series and Parallel inverters.

EC630: ADVANCED MICROCONTROLLERS

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC630	Advanced Microcontrollers	4	-	-	4	50	50	100

Course outcomes:

Upon completion of this course, student should be able to:

1. Learn the basic architecture of microcontrollers 8051
2. Learn the instruction set and programming of microcontrollers 8051 . .
3. Know how to interface external peripherals to 8051 and write program for different applications.
4. Learn the basic architecture of microcontrollers ARM CORTEX M3.
5. Learn the instruction set and programming of microcontrollers ARM CORTEX M3 and the features of ARM CORTEX M3.

. . .

Syllabus:

Unit 1: 8051 Microcontroller:- Architecture, 8051 hardware, i/o and o/p pins, ports and port circuits, external memory, counters and timers, serial communication. 10 hrs.

Unit 2: Addressing modes & instructions:- Addressing modes, external data moves, code memory read only data moves, PUSH & POP op-codes, data exchanges, arithmetic, logical, jump and call instructions. 10hrs

Unit 3: Timer/counter, serial communication and interrupt programming:-Programming 8051 timer/counter, basics of serial communication, 8051 connection to RS 232, 8051 serial port programming, 8051 interrupts, programming timer interrupts, programming external hardware interrupts, programming serial communication interrupts. Interfacing keyboard, LCD, ADC, DAC, Stepper motor. 12hrs

Unit 4: Introduction to architecture of ARM Cortex M3: General Purpose Registers, Stack Pointer, Link Register, Program Counter, and Special Register. Stack implementation. Bus interfaces. 10 hrs.

Unit 5: Exceptions, vector table, Interrupts, advanced programming features, memory protection, and power management. . Debug Architecture. 08 hrs.

References Books:

1. Kenneth J Ayala : "***The 8051 Microcontroller Architecture, Programming and Application " -*** 2ed Penram International 1996.

2. Muhammad Ali Mazidi and Janice Gillespie : "***The 8051 Microcontroller and embedded Systems-"*** ' -Pearson Education 2003.

3. David Patterson and John L. Henessay: "***Computer Organization and Design***", (ARM Edition), Morgan Kauffman.

EC 640: Digital Communication

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 640	**Digital Communication**	**4**	**-**	**-**	**4**	**50**	**50**	**100**

Course outcomes:

Upon completion of this course, student should be able to:

CO1: Demonstrate their familiarity with the importance and usefulness of Digital communication and techniques and their performance assessment

CO2: Explain and analyse the principles of Baseband transmission, ISI, equalization and M ary systems in Digital communication

CO3: Model and analyse the principles and techniques related to Digital Modulation

CO4: Model and analyse the necessity, principles and applications of Spread spectrum systems

CO5: Demonstrate the concepts and applications of Information theory and coding techniques and exhibit familiarity with respect to recent developments in Digital Communication.

Unit 1: Basic signal processing operations in digital communication. Sampling Principles: Sampling Theorem, Quadrature sampling of Band pass signal, Practical aspects of sampling and signal recovery**.**

PAM, TDM. Waveform Coding Techniques, PCM, Quantization noise and SNR, DPCM, DM

10 hours

Unit 2: Line Coding, Base-Band Shaping for Data Transmission, Discrete PAM signals, power spectra of discrete PAM signals**.**

ISI, Nyquist criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

10 hours

Unit 3: Digital Modulation formats, Coherent binary modulation techniques, Coherent Quadrature modulation techniques. Non-coherent binary modulation techniques.

8 hours

Unit 4: Spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum, coherent binary PSK, frequency hop spread spectrum, applications**.** **8 hours**

Unit 5: Basics of Information and Coding theory. Shannon's theorem Source coding and error control coding, Recent developments and articles from latest publications

9 hours

References:

1. **Simon Haykin :** Digital communications, , John Wiley, 2003.
2. **K. Sam Shanmugam** : Digital and Analog communication systems & An Introduction to Analog and Digital Communication, John Wiley, 1996.
3. **T.L. Singal**: Digital Communication McGraw-Hill, India 2015
4. **Andy Bateman**: Digital Communication for the real World. Pearson Education, First Edition, 2009
5. **Bernard Sklar** Digital communications -: Pearson Education 2007
6. **Ian A Glover and Peter M Grant:** Digital Communications 2nd Ed **,** Pearson Education, 2008

EC650 Mobile Communication

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 630	Mobile Communication	4	-	-	4	50	50	100

Course Outcomes:

Upon completion of this course, student should be able to:

1. Understand the different generations of mobile communication systems and its components.
2. Understand the Architecture and operations of wireless mobile network and Capacity expansion techniques.
3. Understand the operation of the GSM system, GSM protocol architecture. TDMA and CDMA technologies.

4. Design and construction of different Wireless Modulation techniques.

5. Understand the working of wireless technologies like WLAN 802.11X, 802.15X, Bluetooth and broadband wireless man 802.16X.etc.

Syllabus:

Unit 1: Introduction to wireless telecommunication systems and Networks

History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks.

Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Call establishment.

10 hrs

Unit 2: Wireless network architecture and operation

Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security

GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers **10 hrs**

Unit 3: GSM system operations

Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems CDMA technology, CDMA overview, CDMA channel concept CDMA operations **10 hrs**

Unit 4: Wireless Modulation techniques and Hardware

Characteristics of air interface, Path loss models, wireless coding techniques, , OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware **10 hrs**

Unit 5: Introduction to wireless LAN 802.11X technologies

Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies. **10 hrs**

Text books:

1. Mullet: ***Wireless Telecom Systems and networks***, Thomson Learning 2006.

Reference books:

1. T.S.Rappaport **:** ***Wireless Communications: Principles and Practice***, Second Edition, Pearson Education.2003.
2. 2. Lee W.C.Y: ***Mobile Cellular Telecommunication***, MGH, 2002.

3. D P Agrawal: ***Wireless communication*** 2nd Edition Thomson learning 2007

4.David Tse, Pramod Viswanath: ***Fundamentals of Wireless Communication***, Cambridge 2005

EC 660: Operating Systems

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 660	Operating Systems	4	-	-	4	50	50	100

Course outcomes:

Upon completion of this course, student should be able to:

1. understand the structure of operating system.
2. Analyze the different process scheduling concept.
3. Analyze the concept of memory usage.
4. Understand the concept usage of paging techniques.
5. Analyze the situation to handle different types of files & design system to avoid deadlock .

Syllabus:

UNIT – 1 :

INTRODUCTION AND OVERVIEW OF OPERATING SYSTEMS: Operating system, Goals of an O.S, Operation of an O.S, Resource allocation and related functions, User interface related functions, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems. Structure of the supervisor, Operating system with monolithic structure, layered design, Virtual machine operating systems,

Kernel-based operating systems, microkernel based OS **10Hours**

UNIT – 2:

PROCESS MANAGEMENT: Process concept, Programmer view of processes, OS view of processes, Interacting processes, Threads. Fundamentals of scheduling, Long-term scheduling, Medium and short term scheduling, Real time scheduling. **10hours**

UNIT - 3

MEMORY MANAGEMENT: Memory allocation to programs, Memory allocation preliminaries, Contiguous and noncontiguous allocation to programs, Memory allocation for program controlled data, kernel memory allocation.

10hours

UNIT -4

Virtual memory: Virtual memory using paging, Demand paging, Page replacement, Page replacement policies, Memory allocation to programs, Page sharing

10hours

UNIT – 5

Deadlock : Deadlocks in resource allocation , deadlock detection & resolution , dead lock prevention , deadlock avoidance.

FILE SYSTEMS: File system and IOCS, Files and directories, Overview of I/O organization, Fundamental file organizations, Interface between file system and IOCS, Allocation of disk space, Implementing file access, UNIX file system. **10hours**

REFERENCES

1. ***"Operating Systems - A Concept based Approach"***, **D.M.Dhamdhare,** TMH, 3rd Ed, 2006.
2. ***Operating Systems Concepts***, **Silberschatz and Galvin**, John Wiley, 8th Edition, 2001.
3. ***Operating System – Internals and Design Systems***, **Willaim Stalling**, Pearson Education, 4th Ed, 2006.

EC 61L: Design and Implementation Lab

Course code	Course title	Hours/week			Credits	CIE	SEE	Total
		L	T	P		Marks	Marks	Marks
EC61L	Design and Implementation Lab	-	-	1.5	1.5	50		50

Course outcomes:

1. Demonstrate a hardware project based on problem formulation, design, testing, , analysis and fabrication.

2. Document the various stages of the project in a standard format with technical and related contents.
3. An oral presentation highlighting the design and fabrication process along with a performance assessment.

EC62L: MICROCONTROLLER LAB

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC62L	**Microcontroller lab**	-	**-**	**1.5**	**1.5**			**50**

Course Outcomes:

Upon completion of this course, student should be able to:

1. Know architecture and instruction set of 8051and ARM microcontroller.
2. Write programs using data transfer, arithmetic, logical and branch instructions.
3. Write programs based on timer, ADC, DAC, OPAMP, and LCD.
4. Write program based on interrupts, communication ports.

Lab experiments:

Software programs: Repeat for both 8051 and ARM microcontroller

1. Problems related with data transfer and exchange.

2. Problems related with arithmetic and logical operations.

3. Problems related with programming timers in all modes with and without interrupts.

4. Problems related with programming serial communication with and without interrupts.

5. Program related with handling external interrupts.

Hardware programs: repeat with 8051 and ARM (using embedding c)

1. Interface LCD.

2. Interfacing of matrix keypad.

3. Interfacing of ADC.

4. Interfacing of DAC.

5. Interfacing of multi digit 7 segment display.

6. Interfacing of stepper motor and D C motor.

EC 63L: Networking Lab

Course code	Course title	Hours/week			Credits	CIE Marks	SEE Marks	Total Marks
		L	T	P				
EC 63L	Networking Lab	0	0	1	1	50	-	50

Lab Activities:

1. Experiments based on CISCO Packet Tracer for network configurations; Network addressing, Subnetting and super netting, Routing protocols, and Router configurations
2. VLANs, wireless LANs, Programming exercises on networking algorithms
3. Verification of various network scenarios on Exata Software
4. Pinging and Tracing to test the path
5. Trouble shooting and Verifying IPv4and IPv6 addressing
6. TCP and UDP communications
7. Subnetting scenarios
8. Investigating the TCP/IP OSI model
9. Connect a router to LAN
10. Investigate unicast, broadcast and multicast traffic instructions
11. Identify MAC and IP Addresses
12. Packet Tracer – Examine the ARP Table
13. Packet Tracer – Configure Layer 3 Switches
14. Packet Tracer – DHCP and DNS Servers
15. Packet Tracer – FTP Servers

VII semester

EC 710 VLSI CIRCUITS AND SYTEMS 3:0:1

Unit 1:

Introduction: A Brief History, MOS Transistors, CMOS Logic, CMOS fabrication and Layout, VLSI Design Flow, Fabrication, Packaging, and Testing **8 Hours**

Unit 2:

MOS Transistor Theory: Introduction, Ideal I-V Characteristics, C-V Characteristics, Non ideal I-V Effects, DC Transfer Characteristics, Switch - level RC Delay Models **8 hours**

Unit 3:

Circuit Characterization and Performance Estimation**:** Introduction, Delay Estimation, Logical effort and transistor sizing, Power Dissipation, Interconnect, Design Margin, Reliability **8 Hours**

Unit 4:

Circuit Simulation**:** Introduction: A Spice Tutorial, Device Models, Device Characterization, Circuit Characterization, Interconnect Simulation **8 Hours**

Unit 5:

Combinational and Sequential circuit design: Introduction, Circuit families, Sequencing static circuits, Circuit design of Latches and Flip-flops

Recent trends and current publications: Nalwa ”Handbook of Advanced electronics and Photonic Materials and Devices” , Volume 1-10, Academic Pres, IEEE transactions on electronic devices. **8 hours**

Lab course will be conducted with available Microwind tool. Design of layout and circuit simulation will be carried out.

References:

1. **Neil H.E. Weste, David Harris, Ayan Bannerjee:** CMOS VLSI DESIGN: A Circuits and Systems Perspective, 3rd Edition, Published by Pearson Education, 2005.
2. **Douglas. A. Pucknell, Kamran Eshragian:** Basic VLSI Design, 3rd Edition, Eastern Economy Edition, 1994.
   R. Jacob, W. Li, David .E. Boyce: CMOS Circuit Design, Layout, and Simulation, Prentice Hall India, 1998

EC 720 OPTICAL FIBER COMMUNICATION 4:0:0

EC 732 DIGITAL IMAGE PROCESSING 3:0:0

Course Outcomes

1. Acquire knowledge on Digital image fundamentals and Image enhancement in spatial domain.

2. Acquire knowledge on image enhancement techniques in frequency domain using transforms.

3. Ability to analyze and apply basic morphological algorithms for digital image processing.

4. Acquire comprehensive knowledge on various color models and basic segmentation techniques.

5. Acquire knowledge on basic image compression techniques and exposure to the state of the art techniques on character and face recognition.

Unit 1

Digital Image Fundamentals: Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, 2D sampling theorem, Basic relationships between pixels.

Image Enhancement in Spatial Domain: Basic gray level transformations, histogram processing, equalization, enhancement, image subtraction, averaging, smoothing and sharpening using spatial filters and their combination. **8 hours**

Unit 2

Image Enhancement in Frequency Domain: 2D DFT, Convolution, correlation, FFT and IFFT in 2D, Correspondence between filtering in spatial and frequency domain, smoothing and sharpening using Butterworth and Guassian Lowpass and highpass filters. **8 hours**

Unit 3

Basic Morphological Algorithms: Dilation and erosion, Opening and closing, The Hit or Miss transformation, Boundary extraction, Region filling, Extraction of connected components,

Convex Hull, Thinning, Thickening and Pruning.
8 hours

Unit 4

Color image processing: Color models RGB, CMY, CMYK, HSI, Color transformations, Converting colors from RGB to HSI and HIS to RGB, Pseudo color image processing

Image segmentation: Point, line and edge detection (Robert, Canny and Prewitt techniques).
8 hours

Unit 5

Image Compression: Fundamentals, Some basic compression methods- Huffman, Arithmetic and LZW coding techniques, Digital image watermarking.

Recent trends and Case studies: Character and face recognition problems from recent journal publications.

8 hours

References:

1. **Rafael C. Gonzalez, Richard E. Woods:** Digital Image Processing, Pearson Prentice Hall, 2009
2. **Anil K. Jain:** Fundamentals of Digital Image Processing, Prentice Hall India, 1989.
3. **John C Russ,** TheImage Processing Handbook, 5^{th} edition, 2006, CRC Press

VIII semester

EC 810: ENTERPRENEURSHIP AND MANAGEMENT 4:0:0

Unit 1

Entrepreneurship: Concept, meaning, need and Competencies/qualities/traits of an entrepreneur, technopreneurship. Innovation: Introduction, Motivating to innovate, Introduce core ideas about how to think about innovation, including key theories about factors that affect innovation. An in depth review of how companies structure to encourage and develop innovation. Product development and design. **10 hours**

Unit 2

Role of financial institutions in entrepreneurship development Role of financial institutions in entrepreneurship development like District Industry Centres (DICs), State Financial Corporations, Small Industries Service Institutes (SISIs), Small Industries Development, Bank of India (SIDBI), National Small Industries Corporation (NSIC) and other relevant institutions/organizations.

Market Survey and Opportunity Identification (Business Planning) **:**How to start an industry, procedures for registration of industry, assessment of demand and supply, in potential areas of growth, understanding business opportunity, considerations in product selection, data collection for setting up new ventures **10 hours**

Unit 3:

Introduction to Engineering Management**:** Engineering and Management, historical development of engineering management.

Functions of technology management: planning and forecasting, decision making, organizing, motivating and leading technical people, controlling. **10 hours**

Unit 4:

Managing projects: Project planning and acquisition, project organization, leadership and control. Case Studies **10 hours**

Unit 5

Project Report Preparation**:** Preliminary report, Techno-economic feasibility report, Project viability. Case studies examples **10 hours**

Text Books:

1. **Peter Duckers**, Innovation and Entrepreneurship Practice and Principles,

Heinnemann, 1985

2. **Babcock and Morse**, Managing Engineering and Technology , Pearson Education, 2004.

References:

1. **B. S. Rathore and J. S. Saini**, A Handbook of Entrepreneurship, Aapga Publications, Panchkula (Haryana)

2. **C. B. Gupta and P. Srinivasan** , Entrepreneurship Development, Sultan Chand and Sons, New Delhi, 1999

3. **J. Tidd, J. Bessant and K. Pavitt**, Managing Innovation: Integrating Technical, Market and Organizational Change, Wiley, 3rd ed, 2005

EC 831 DATA COMPRESSION 3:0:0

Course Outcomes

1. Acquire knowledge on fundamental concepts of information theory, lossless compression and coding techniques.

2. Ability to apply coding techniques like Huffman, Adaptive Huffman and Arithmetic coding for data compression.

3. Ability to apply static and adaptive dictionary techniques for lossless data compression. Acquire knowledge on fundamental concepts of Lossy compression techniques.

4. Acquire comprehensive knowledge on Quantization techniques and transform coding.

5. Acquire knowledge on basic concepts of sub-band coding and wavelet transforms for 2D data compression and ability to apply them**.**

Unit 1

Introduction: Lossless compression, Lossy compression, Modeling and coding, Brief review of information theory, Mathematical preliminaries for lossless compression, Minimum description length principle, physical, probabilistic, Markov models. **8 hours**

Unit 2

Huffman coding algorithm, Adaptive Huffman coding, Applications of Huffman coding to text and audio processing, Arithmetic coding, generating and deciphering the tag, Binary coding, Comparison with Huffman coding, Adaptive arithmetic coding and applications.**8 hours**

Unit 3

Dictionary techniques: static/adaptive dictionary, Applications: UNIX compress, GIF image compression, JPEG, JPEG-LS *lossless* compression techniques,Mathematical preliminaries for *Lossy* Compression techniques: Distortion criteria, conditional entropy, differential entropy, Models: physical, probabilistic, linear system models.**8 hours**

Unit 4

Scalar quantization, uniform, Adaptive quantizer, Vector quantization, Advantages of VQ over SQ, LBG algorithm. Transform coding: Karhunen-Loeve transform, DCT, Quantization and coding of transform coefficients, JPEG for image and Modified DCT for audio compression.

8 hours

Unit 5

Sub band coding algorithm: analysis, quantization, coding, synthesis, Wavelets: Multi-resolution analysis and scaling function, implementation using filters, image compression using wavelets, Embedded Zerotree Coder, Set partitioning in Hierarchical tress, JPEG 2000. **8 hours**

References:

1. **Khalid Sayood**, Introduction to Data Compression, 4th edition, Elsevier Inc, 2012.
2. **David Solomon, Giovanni Motta,** " Handbook of Data Compression", 5th Edition, Springer, 2010

EC 844 OPTICAL NETWORKS 3:0:0

Program Outcomes:

1. Gain a clear insight into the optical networking technology by understanding the physics and technology of optical networking devices and systems
2. Able to demonstrate skills related to analysis, simulation and design issues related to optical networks
3. Be able to relate the basics learnt to trends in optical network implementations, test beds and simulation tools.
4. Be able to analyse, model and formulate various optical networking problems and thereby develop problem solving skills.

Unit 1:

Introduction to optical networks: Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, System and network evolution. Non linear effects SPM, CPM, four wave mixing, **08 hours**

Unit 2:

Components: Couplers., isolators and Circulators, Multiplexes and filters Optical amplifiers Transmitters, detectors, Switches, Wavelength converters **08 hours**

Unit 3:

Transmission system Engineering: System model, Power penalty, Transmitter, receiver, optical amplifiers, Crosstalk, Dispersion, Overall design Consideration

First generation networks, SONET/SDH, Optical transport networks, IP,MPLS,WDM network elements, ,OADM, Optical cross connects **08 hours**

Unit 4:

WDM Network Design: Cost tradeoffs, LTD and RWA problems, Dimensioning wavelength routed networks, Access networks: Network architecture overview, present and future access networks, HFC, FTTC, PON **08 Hours**

Unit 5:

Photonic packet switching, OTDM, Multiplexing and demultiplexing, Synchronisation.

Recent developments and trends **08 hours**

Text Book:

1. Kumar Sivarajan and Rajiv Ramaswamy: Optical networks: A practical perspective Elsivier and Morgan Kauffman publishing, Third Edition, 2010

Reference:

1. Biswajit Mukherjee: Optical communication networks: TMG 1998
2. Ulysees Black: Optical networks, Pearson education 2007