S. Y. B. Tech. Autonomy Structure & Syllabus

S. Y. B. Tech. Electronics & Telecommunication Engineering Semester – I										
Course Code	**Course Title**	**Teaching Scheme**			**Examination Scheme**				**Marks**	**Credit**
		Hours/Week								
		Lecture	**Tutorial**	**Practical**	**In Semester**	**End Semester**	**Oral**	**Practical**		
EC 2101	**Electronic Devices and Circuits**	3	1	0	50	50	0	0	100	4
EC 2102	**Network Theory**	3	1	0	50	50	0	0	100	4
EC 2103	**Digital Electronics**	3	1	0	50	50	0	0	100	4
EC 2104	**Data Structures**	3	0	0	50	50	0	0	100	3
BSEC2101	**Engineering Mathematics-III**	3	1	0	50	50	0	0	100	4
EC 2105	**Electronic Devices and Circuits Lab**	0	0	4	0	0	0	25	25	2
EC 2106	**Digital Electronics Lab**	0	0	2	25	0	0	0	25	1
EC 2107	**Data Structures Lab**	0	0	4	0	0	50	0	50	2
	Total	**15**	**4**	**10**	**275**	**250**	**50**	**25**	**600**	**24**
	Grand Total	**29**							**600**	**24**

S. Y. B. Tech. Autonomy Structure & Syllabus

S. Y. B. Tech. Electronics & Telecommunication Engineering Semester – II										
Course Code	**Course Title**	**Teaching Scheme**			**Examination Scheme**				**Marks**	**Credit**
		Hours/Week								
		Lecture	**Tutorial**	**Practical**	**In Semester**	**End Semester**	**Oral**	**Practical**		
EC 2201	**Signals & Systems**	3	1	0	50	50	0	0	100	4
EC 2202	**Analog Communication**	3	1	0	50	50	0	0	100	4
EC 2203	**Integrated Circuits and Applications**	3	1	0	50	50	0	0	100	4
EC 2204	**Object Oriented Programming**	3	0	0	50	50	0	0	100	3
HS 2201	**Principles of Economics and Finance**	3	0	0	50	50	0	0	100	3
EC 2205	**Analog Communication Lab**	0	0	2	0	0	0	25	25	1
EC 2206	**Integrated Circuits and Applications Lab**	0	0	2	25	0	0	0	25	1
EC 2207	**Object Oriented Programming Lab**	0	0	4	0	0	25	0	25	2
AC 2201	**Self Expression**	0	0	2	0	0	0	0	0	No credit
	Total	**15**	**3**	**10**	**275**	**250**	**25**	**25**	**575**	**22**
	Grand Total	**28**							**575**	**22**

EC2101 Electronic Devices And Circuits

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination scheme:
In Semester:50 Marks
End Semester:50 Marks
Credits: 4

Course Objectives:

1. Introduce the characteristics, working principles as well as concept of load line and operating point of FETs for analyzing DC circuits
2. Explain the concepts of employing simple models to represent non linear elements such as JFETs and MOSFETs
3. Analyze JFET and MOSFET amplifiers and discuss general frequency response of amplifiers
4. Impart the knowledge of feedback and its effects on characteristics of amplifier
5. Familiarise the students with audio power amplifiers using BJTs

Course Outcomes:
Having successfully completed this course, the student will be able to:

1. Explain characteristics of FETs and determine transistor parameters
2. Analyze RC coupled amplifier for DC and AC conditions
3. Determine the frequency response of transistorised RC coupled circuits
4. Analyze effect of negative feedback on amplifier parameters. Explain principle of working of oscillators and calculate frequency of oscillation for given circuit
5. Calculate efficiency and harmonic distortion for Class A, Class B and Class AB Power Amplifiers and compare them

Unit 1: JFET **(09)**
Introduction, Construction and working, JFET characteristics (Transfer and Drain), Schockley's equation, JFET biasing and DC analysis, JFET as amplifier and its configurations (CS/CD/CG) and comparison, CS amplifier analysis.

Unit 2: MOSFET **(10)**
Two terminal MOS structure, EMOSFET-construction, symbols, Ideal EMOSFET V-I characteristics, additional MOSFET structures (DMOSFET and CMOS), non-ideal V-I characteristics of EMOSFET (finite output resistance, body effect, break down effect, temperature effect, short channel effects), MOSFET biasing and DC circuit analysis, MOSFET small signal amplifier (CS configuration).

Unit 3: Frequency response of amplifiers **(07)**
General frequency response for RC coupled amplifier, Low frequency response, Miller effect, High frequency response, Multistage frequency effects, square wave testing for RC coupled amplifiers.

Unit 4: Feedback Amplifiers and Oscillators **(08)**

Classification of amplifiers, feedback concept, General characteristics of negative feedback amplifiers, Feedback Topologies, Barkhausen criterion, sinusoidal oscillators: RC Phase shift and LC oscillators, Crystal oscillators.

Unit 5: Power Amplifiers **(08)**

Types (Class A, B, AB and C) and their comparison, Second Harmonic distortion, Analysis of Class A, Class B and Class AB amplifiers, Introduction to Class C amplifiers.

Text books:

1. R.L.Boylstad, L.Nashlesky, **'Electronic Devices and Circuits Theory'**, *PrenticeHall of India,* (9th Edition), (2006).
2. Donald Neaman,**'Electronic Circuit Analysis and Design'**, *Tata McGraw Hill,* (3rd Edition), (2007).

Reference Books:

1. David A. Bell, **'Electronic Devices and Circuits'**, *Oxford,* (5th Edition), (2008).
2. Millman , Halkias, **'Integrated Electronics- Analog and Digital Circuits and Systems'**, *Tata McGraw Hill,* (2nd Edition), (2010).

Websites:

1. http://nptel.ac.in/courses/117103063/24
2. http://nptel.ac.in/courses/117103063/17
3. http://www.iitg.ac.in/apvajpeyi/ph218.html
4. http://nptel.ac.in/courses/117101105/3

List of Tutorials:

1. Design biasing circuit for JFET.
2. Analyze JFET amplifier.
3. Analyze MOSFET amplifier.
4. Analyze Multistage amplifiers.
5. Analyze effect of negative feedback on amplifiers.
6. Design Oscillator Circuit.
7. Analyze Power Amplifiers.

EC 2102 Network Theory

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

1. Explain and apply fundamentals of network simplification techniques
2. Explain and apply network theorems to find network quantities
3. Impart knowledge of series and paralle resonant circuits
4. Analyze and apply transient analysis of RL,RC and RLC circuits
5. Familiarize students with two-port network and filter design analysis

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Apply fundamental laws and theorems to find current and voltages in elements of electrical network
2. Determine bandwidth and selectivity in resonant cicuits
3. Find and analyse initial conditions and responses of RL,RC and RLC circuits for standard excitation signals
4. Design prototype filters and simplify two port networks to determine the network parameters

Unit 1: Network Theorems (10)

Basic Circuit Analysis and Simplification Techniques such as Mesh Analysis, Nodal Analysis, Source Transformation and Source Shifting, Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem (AC & DC analysis)

Unit 2 :Resonance (06)

Series Resonance: Impedance,voltage and current variations with frequency,Bandwidth, Selectivity. Effect of generator resistor on bandwidth and Selectivity, Parallel resonance: Admittance variation with frequency, Bandwidth and selectivity Comparison and applications of series and parallel resonant circuits

Unit 3:Transient Analysis (10)

Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations, Initial conditions – Classical method and Laplace transforms methods of solutions. Transient response of R-L, R-C, R-L-C circuits for standard inputs such as step, ramp, pulse and impulse by using Laplace transforms method

Unit 4 : Filters and Attenuator **(08)**

Filters and Attenuators- Classifications of Networks in Symmetrical and Asymmetrical networks. Properties of two port Symmetrical Networks (T and Π only): Characteristic Impedance (Z0) and Attenuation Constant (γ) in terms of circuit components. Filters: Filter fundamentals, Constant K-Low Pass Filter (LPF), High Pass Filter (HPF), Band Pass Filter (BPF) and Band Stop Filter (BSF). Attenuators: Introduction to Neper and Decibel. Symmetrical T and Π type attenuators

Unit 5 : Two Port Network **(08)**

Two Port Network Parameters and Functions- Terminal characteristics of network: Z, Y, h and ABCD Parameters, Reciprocity and Symmetry conditions, Applications of the parameters

Text Books:

1. D Roy Choudhury, '**Networks and Systems**', *New Age International Publishers,* (1st Edition), Reprint, (2005).
2. Ravish R. Singh, '**Network analysis and Synthesis**', *McGraw Hill Education*, (2013).

Reference Books:

1. John D. Ryder, '**Network Lines and Fields**', *PHI Publications,* (1st Edition) ,(1990).
2. M. E. Van Valkenburg, '**Network Analysis**', *PHI / Pearson Education*, (3rd Edition), Reprint (2002).

Website:

1. http://nptel.ac.in/courses/108102042/

List of Tutorials:

1. Calculation of voltage, current and power using KVL ,KCL,Mesh and Nodal analysis.
2. Calculation of voltage, current and power using Superposition & Thevinin's Theorem.
3. Calculation of voltage, current and power using Norton's & Maximum Power Transfer Theorem.
4. Bandwidth and selectivity calculation in Series and Parallel Resonant Circuits.
5. Determination of intial conditions of RL, RC and RLC circuits with laplace transform.
6. Determination of network quantities in RL, RC and RLC circuits with laplace transform.
7. Designing of Constant K-LPF, HPF, BPF and BSF.
8. Calculation of Z, Y, h, ABCD parameters for given circuit.

EC 2103 Digital Electronics

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

1. Introduce the techniques for the simplification of logic function and design arithmetic circuits
2. Make students familiar with design and applications of combinational circuits using basic logic gates and MSI chips
3. Introduce the sequential circuits, their functionality, design and applications
4. Acquaint the students with the design and implementation of state machines
5. Make students familiar with logic families, Programmable Logic Devices and VHDL

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Apply reduction techniques to design basic combinational circuits
2. Design combinational and sequential circuits using basic gates and MSI chips
3. Design sequential circuits using state machines
4. Explain digital logic families and Programmable Logic Devices
5. Explain modeling styles of VHDL and design combinational and sequential circuits using VHDL

Unit 1 : Combinational Logic Design (07)

Standard representations for logic functions, k map representation of logic functions, SOP and POS forms, min-terms and max-terms, minimization of logical functions up to 4 variables, don't care conditions. Design Examples: Arithmetic Circuits: Adders and subtractors, Digital Comparator, ALU, code converters.

Unit 2 : Combinational Logic Design using MSI chips (06)

Circuit design using adder, comparator ICs. Multiplexers and their use in combinational logic designs, multiplexer trees, Demultiplexers and their use in combinational logic designs, Demultiplexer trees , Decoders.

Unit 3 : Sequential Logic Design (08)

One bit memory cell, Clocked SR, D, MS J-K flip-flop and T flip-flops, Use of preset and clear terminals, Excitation table for flip-flops, Conversion of flip-flops. Application of flip-flops: Shift registers, sequence generators, counters: ripple counters, up/down counters, synchronous counters.

Unit 4 : State Machines **(06)**

Mealy and Moore machines representation. Design of state machines using State diagram, State table, State reduction, State assignment. Design of sequential circuit using Finite state machine.

Unit 5 : Digital Logic Families **(05)**

Classification of logic families, Characteristics of digital ICs: Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. Operation of TTL NAND gate, active pull up, wired logic. CMOS logic: CMOS inverter, NAND, NOR gates, Comparison between TTL, CMOS technologies.

Unit 6 : Introduction to VHDL, Programmable Logic Devices **(06)**

Introduction to VHDL, Entity declaration, architecture, modelling styles, data objects, concurrent and sequential statements. Simple design examples using VHDL for basic combinational and sequential circuits, attributes. Introduction to Programmable logic devices and their types: ROM, PLA, CPLD, FPGA.

Text Books:

1. R.P. Jain, **'Modern digital electronics'**, *TMH Publication,* (4th edition), (2007).
2. Anand Kumar, **'Fundamentals of digital circuits',** *PHI Publication*, (1st edition),(2001).
3. J. Bhaskar, **'VHDL Primer'**, *PHI Publication,*(3rd Edition), (2015).

Reference Books:

1. Wakerly, **'Digital Design Principles and Practices'**, *Pearson Education*, (3rd edition), (2004.)
2. Stephen Brown, **'Fundamentals of digital logic design with VHDL'**, *TMH Publication*, (1st edition), (2002).

Website:

1. http://nptel.ac.in/courses/117106086/1

List of Tutorials:

1. Minimize the logic functions and realize using universal gates.
2. Design code converters using basic gates.
3. Design a combinational circuits using multiplexer.
4. Realize the multiple output functions using decoder.
5. Conversion from one type of Flip- Flop to another type.
6. Design mod-N asynchronous counter.
7. Design mod-N synchronous counter.
8. Design sequence generator using shift register.

EC 2104 Data Structures

Teaching Scheme
Lecture: 3 Hours/Week

Examination Scheme
In Semester: 50Marks
End Semester: 50Marks
Credits:3

Course Objectives:

1. Introduction to the theory, practice and methods of data structures
2. Introduce elementary data structures such as Arrays, Linked lists and model other data structures
3. Learn modeling of linear data structures like stacks and queues
4. Learn modeling of non-linear data structures like trees and graphs

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Classify and categorize data structures that make up for a programming language
2. Infer to the modeled data structures from the premise of the baseline models
3. Make use of algorithms on linear and non-linear data structures for performing different operations on data
4. Perceive the importance of appropriate memory allocation and efficient management in the time-space domain

Unit 1: Introduction, Arrays & Functions in C (09)

Introduction: Overview of Compiler and the 'C' development life cycle, brief overview of Operating System. Software Development Life Cycle (SDLC), Arrays: Single dimensional & Two dimensional Arrays. Searching Methods: Algorithms for Sequential Search, Indexed Sequential Search, and Binary Search. Sorting Methods: Algorithms for Selection sort, Bubble sort, Insertion sort. Introduction to Time complexity and Space complexity, brief overview of the Big Oh, and other notations as performance metrics for the algorithms. Abstract Data Type (ADT): Definition, ADT for arrays. Functions: Types of functions and their categories with appropriate examples. Parameter passing by value, parameter passing by reference, recursive functions.

Unit 2: Pointers & Structures in C (07)

Pointers: Basic concepts. Pointer declaration & initialization. Scale factor. Pointer to a pointer. Strings: Basic concepts. Structures in C: Concept, comparison with arrays as a data structure. Array of structures, pointers and arrays, pointers and structures. Bitwise Operators, Concept of ordered list & polynomial representation using array of structures.

Unit 3: Data Structure Using Linked Organization (07)

Concepts and definition of data, data type, data object, data structures. Concept of Singly Linked List: Algorithms for Creation, Insertion, deletion and traversals of above data structure. Concept of Doubly Linked List and Circular Linked List. Applications of Linked lists. Generalized linked list: Representation of polynomial using GLL.

Unit 4: Stacks and Queues **(07)**

Stacks: Definition & example, representation using arrays & linked list. Applications of Stacks: Concept of infix, postfix and prefix expressions, conversion of infix to postfix expression, evaluation of postfix expression. Queues: Definition & example, representation of queue using array and linked list. Concept of Circular queue, concept of priority queue, Applications of Queue.

Unit 5: Trees **(07)**

Difference between Linear and Non-linear data structures. Binary trees (BT): Basic terminology. Types of Binary Trees. Binary Search Tree (BST): Difference between BST and BT. Representation of BST(Static and Dynamic), Algorithms for BST traversals – preorder, inorder & postorder(recursive), Primitive operations on BST: Create, insert, delete. Algorithm for Non-recursive in-order traversals for BST.

Unit 6: Graphs **(05)**

Graphs: Concepts and terminology, Types of graphs—directed graph, undirected graph, planar graph, representation of graph using adjacency matrix, adjacency list, Traversals: DFS & BFS. Minimal spanning tree: Kruskal, Prim's algorithm.

Text Books:

1. Seymour Lipschutz, '**Data Structure with C',** Schaum's Outlines, *McGrawHill Education (India) Pvt. Ltd,* Special Indian Edition*,* (2013).
2. E Balgurusamy, '**Programming in ANSI C**', *Tata McGraw-Hill*,(3rdEdition), (2008).

Reference books:

1. Richard F. Gilberg & Behrouz A. Forouzan, '**Data Structures A Pseudocode Approach with C**', *Cengage Learning*, (2nd Edition) , (2005).
2. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum, '**Data structures using C and C++**', *PHI Publications*, (2nd Edition), (2004).
3. Ellis Horowitz, SartajSahni, '**Fundamentals of Data Structures in C'**, *Universities Press,* (2nd edition), (2008).

BSEC 2101 Engineering Mathematics III

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:
Mathematics is a necessary path to scientific knowledge which opens new perspective of mental activity. Our aim is to provide sound knowledge of engineering mathematics to make the students think mathematically and strengthen their thinking power to analyse and solve engineering problems in their respective areas.

Course Outcomes:
Having successfully completed this course, the student will be able to:

1. Write the formulae of Fourier and Laplace transforms, LDE, Vector calculus, complex analysis
2. Identify the techniques to solve the problems of Fourier and Laplace transforms, LDE, Vector calculus, Complex analysis
3. Apply the concepts of Fourier transform, Laplace transforms techniques, methods of solving LDE, Vector analysis, complex analysis in solving problems
4. Classify or differentiate types of LDE and Vector functions, complex analysis
5. Critique / comment on various methods of solving L.D.E.,complex analysis

Unit 1: Higher Order Linear Differential equation and application (08)
Higher order Linear differential Equation with constant coefficients, complementary function, Particular integral, General method, short cut methods, Method of variation of parameter, Cauchy's and Legendre's D.E, Modelling of electrical circuits.

Unit 2 : Fourier Transform (06)
Fourier integral theorem, , Fourier transform, Fourier Sine transform, Fourier Cosine transform, Inverse Fourier Transform, Inverse Fourier sine Transform, Inverse Fourier cosine Transform.

Unit 3: Laplace Transform (08)
Definition of Laplace and Inverse Laplace transform, Properties and theorems, LT of standard functions, LT of some special functions viz. periodic, unit step, unit impulse, ramp function, Inverse Laplace transform using partial fraction, application of LT for solving Linear Differential Equations.

Unit 4 : Vector Differentiation (06)
Physical interpretation of vector differentiation, vector differential operator, Gradient, Divergence, Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, vector identities.

Unit 5 : Vector Integration **(06)**

Line integral, Surface integral, Volume integral, Work done, Green's Lemma, Gauss' divergence Theorem, Stokes Theorem.

Unit 6 : Complex Analysis **(08)**

Functions of Complex variables, Analytic Functions, Cauchy - Riemann Equations, Cauchy's Integral Theorem, Cauchy's Integral Formula, Laurent's series, Cauchy's Residue theorem.

Text Books:

1. B. V. Ramana, **'Higher Engineering Mathematics',** *Tata McGraw Hill Publications,* (2007).
2. B.S. Grewal, **'Higher Engineering Mathematics'***, Khanna publishers, Delhi,(*40th Edition), (2008)
3. Peter V. O'neil, **'Advanced Engineering Mathematics'**, *Thomson Brooks / Cole, Singapore* (5th Edition), (2007).

Reference books:

1. C.R.Wylie,L.C.Barrette, '**Advanced Engineering Mathematics',***McGraw Hill Publications*, New Delhi ,(6th Edition), (2003).
2. Erwin Kreyszig, **'Advanced Engineering Mathematics',** *Wiley Eastern Ltd.,*(8th Edition), (2004).

List of Tutorials:

1. Solution of LDE with constant coefficient
2. Cauchy's, Legendre's DE, electrical circuit
3. Fourier Transform, Fourier integral representation
4. Solution of integral equation using Fourier Transform
5. Examples on Laplace Transform
6. Inverse LT, Initial value problem
7. Directional derivatives, Vector identities
8. Solenodal, irrotational,and Conservative field
9. Line integral, application of Green's theorem
10. Application of Stoke's theorem and Gauss Divergence Theorem
11. Analytic functions, Results using C-R equations
12. Application of Cauchy's Integral formula and Cauchy's Residue theorem

EC -2105 Electronic Devices And Circuits Lab

Teaching Scheme:
Practical: 4 Hrs/Week

Examination Scheme:
Practical: 25 Marks
Credits:2

Course objectives:

1. Build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators
2. Compare the measurements with the behavior predicted by mathematic models and explain the discrepancies
3. Use simulation tool for verifying circuit performance

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Use different instruments for measuring circuit response and troubleshoot the circuits
2. Explain the relationship between the mathematical representation of circuit behavior and corresponding real-life effects
3. Design, implement and analyze electronic circuits like amplifier, switch, oscillator
4. Verify electronic circuits such as amplifiers, oscillators using simulation tool

List of Experiments:

1. Plot V-I characteristics of JFET.
2. Implement biasing circuit for JFET and verify DC operating point.
3. Implement JFET CS Amplifier and calculate Av, Ri and Ro.
4. Determine f_L and f_H of amplifier using square wave testing method.
5. Implement CG and CD amplifier.
6. Analyze the effect of different capacitors on bandwidth of amplifier.
7. Plot V-I characteristics of MOSFET.
8. Plot voltage transfer characteristics of CMOS inverter.
9. Simulate current mirror circuit.
10. Analyze effect of feedback on Av, Ri and Ro.
11. Simulate Oscillator Circuits.
12. Simulate large signal amplifier.

EC 2106 Digital Electronics Lab

Teaching Scheme: **Examination Scheme:**

Practical: 2 Hrs/Week In-Semester: 25 Marks

Credits: 1

Course Objectives:

1. Design digital circuit based on reduction techniques and digital logic
2. Implement combinational logic circuits using MSI chips
3. Design and implement sequential logic circuits using counter ICs
4. Use software tools for simulation of digital circuits

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Identify the functionality of ICs as a multiplexer, decoders and counters
2. Design digital building blocks such as multiplexer, code converter, adder and counters
3. Implement and test digital circuits and verify the truth tables
4. Use the software tools for the simulation of digital circuits

List of Experiments

1. Design and implement combinational circuits using Multiplexer.
2. Design and implement multiple output function using decoder.
3. Design and implement 1 digit BCD adder using IC7483.
4. Design 8 bit magnitude comparator.
5. Design and implement MOD-N asynchronous BCD counter using counter ICs.
6. Design and implement 4 bit counter using preset-table Synchronous counter IC.
7. Write and simulate VHDL code for D FF using synchronous and asynchronous reset input.
8. Write and simulate VHDL code for 4 bit logical and arithmetic operations for ALU.

EC 2107 Data Structures Lab

Teaching Scheme
Practicals: 4 Hours/Week

Examination Scheme
Oral: 50Marks
Credits: 2

Course Objectives:

1. Understand various data searching and sorting methods with pros and cons
2. Understand various algorithmic strategies to approach the problem solution
3. Operate on the various structured data

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Utilize the principal algorithms of sorting and searching on the given data
2. Perceive the representation of data structures like arrays, records, linked lists and their use
3. Implement stacks & queues from the base models
4. Build, represent and traverse non-linear data structures

List of Assignments

Write a C program to implement:

1. Sorting methods – bubble, selection and insertion.
2. Searching techniques- linear and binary.
3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.
4. Polynomial addition using array of structures.
5. Create a singly linked list with options:
   a. Insert (at front, at end, in the middle), b. Delete (at front, at end, in the middle),
   c. Display, d. Display Reverse, e. Revert the SLL.
6. Implement Stack using arrays. Perform following operations on a stack a. Push b. Pop c. Display.
7. Implement Stack using Linked List. Perform following operations on a stack a. Push b. Pop c. Display.
8. Evaluation of postfix expressions (input will be postfix expression).
9. Implement Queue using arrays. Write a menu driven program to perform following operations on a Queue a. Insert b. Delete c. Display.
10. Implement Queue using Linked List. Write a menu driven program to perform following operations on a Queue a. Insert b. Delete c. Display.
11. Binary search tree: Create, search, recursive traversals.
12. Graph using adjacency Matrix with BFS and DFS traversals.
13. Hash Table(Beyond the Syllabus)

EC 2201 Signals and Systems

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:
1. Introduce basic signals and operations on signals
2. Learn systems, types and their analysis
3. Introduce the concept of Fourier transform and its applications
4. Make students familiar with the concept of correlation and spectral density
5. Introduce the concept of Probability theory, distribution and density functions and statistical averages

Course Outcomes:
Having successfully completed this course, the student will be able to:
1. Classify signals and perform operations on signals
2. Analyze a system and identify its type
3. Resolve the signals in frequency domain and plot the spectrum
4. Apply the concepts of correlation and spectral density for different applications
5. Evaluate PDF and CDF for a given problem and to evaluate the statistical parameters

Unit 1: Introduction to Signals (10)
Definition of signals and systems, Conversion of analog signal to digital signal. Classification of signals: Continuous Time (CT) and Discrete Time (DT), Even, Odd, Periodic and Non-periodic, Deterministic and Non-deterministic, Energy and Power. Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and folding, precedence rule. Elementary signals: Exponential, Sine, Step, Impulse and its properties, Ramp, Rectangular, Triangular, Signum, Sinc.

Unit 2: Systems and their analysis (10)
Systems: Definition, Classification: linear and non-linear, time-variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. System modelling: Input-output relation, impulse response, Definition of impulse response, convolution integral, convolution sum, Computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit 3: System Analysis using Fourier analysis (08)
Definition and necessity of CT and DT Fourier Series and Fourier Transform (FT). Orthogonality concept, Magnitude and phase spectrum, CT Exponential Fourier series (FS), CT Fourier Transform and its properties, problem solving using properties, Interplay between time and frequency domain, Inverse Fourier transform.

Unit 4: Correlation and Spectral Density **(08)**

Definition of Correlation and Spectral Density, Correllogram, analogy between correlation and convolution, Auto-correlation and Cross-correlation for CT and DT signals, Energy / Power spectral density of CT signals, properties of correlation and spectral density, inter-relation between correlation and spectral density, Applications of correlation and spectral density.

Unit 5: Probability and Random Variables **(06)**

Sample space, Event, Probability, Conditional probability and statistical independence, Random Variables: Discrete Random Variables, Cumulative Distributive Function, Continuous Random Variable, Probability Density Function, Properties of CDF and PDF, Statistical averages, Mean, Moments and exceptions, Standard Deviation and variance, Probability models: Uniform, Gaussian, Rayleigh, Binomial, Poisson.

Text books:

1. Simon Haykins and Barry Van Veen, '**Signals and Systems'**, *Wiley India,* (2nd Edition),(2004).
2. Simon Haykins, '**An Introduction to Analog and Digital Communications**', *Wiley India,* (2nd Edition), (2008).

Reference Books:

1. Charles Phillips, '**Signals, Systems and Transforms'**, *Pearson Education,* (4th Edition), (2004).
2. Lathi B. P., '**Signals, Systems and Communication**', *BS Publication,* (1st Edition), (2009).
3. Mrinal Mandal and Amir Asif, '**Continuous and Discrete Time Signals and Systems**', *Cambridge University Press,* (1st Edition), (2007).

Website:

1. https://nptel.ac.in/courses/117101055/

List of Tutorials:

1. Classification of the signals as Even/Odd, Periodic / Non-Periodic and Energy / Power.
2. To perform operations like amplitude scaling, addition, multiplication, time scaling, time shifting and folding on CT and DT signals.
3. Apply system analysis to determine whether the given system is, memory less, causal, linear, stable, time invariant, invertible.
4. Perform convolution operation on continuous time and discrete time signals.
5. Apply the concept of Fourier Series on time domain signals.
6. Evaluate ESD and PSD of CT signals.
7. Apply concepts of CDF, PDF and Statistical averages.
8. MATLAB/C assignment on signal operations.

EC 2202 Analog Communication

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course objectives:

1. Explain concepts of amplitude modulation and demodulation
2. Explain concepts of angle modulation and demodulation
3. Calculate the frequency and sketch waveform at stages of superheterodyne radio receiver
4. Compare types of noise and their effect on communication system
5. Explain Pulse Analog Modulation technique

Course Outcomes:

Student will be able to-

1. Identify need for modulation and explain basic concept of amplitude modulation and demodulation
2. Explain the basic concepts of Angle Modulation and demodulation
3. Calculate signal to noise ratio, noise figure and noise temperature of single and cascaded stages in communication system
4. Design FM radio receiver system at block diagram level
5. Explain the concept of pulse amplitude modulation

Unit 1: Amplitude (Linear) Modulation (08)

Block diagram of basic communication system, Base band and Carrier communication, Need for modulation, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, Types of AM: DSBSC – multiplier modulator, Non linear generation, Switching Modulator, Ring modulator and its spectrum, Modulation Index. SSBSC, ISB and VSB, their generation methods and Comparison, AM Broadcast technical standards.

Unit 2 : AM Receiver (08)

Block diagram of AM Superheterodyne Receiver, Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection, Tracking. AM Demodulation: Rectifier detection, Envelope detection. DSB & SSB Detector

Unit 3 : Angle Modulation (08)

Instantaneous frequency, Concept of Angle modulation, frequency spectrum, Narrow band and wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function , Generation of FM (Direct and Indirect Method), Comparison of FM and PM, FM Demodulation.

Unit 4 : FM Receiver (06)

Block diagram of FM Super heterodyne Receiver, Pre emphasis and De emphasis. FM sterio receiver,FM Detection using PLL, FM detector:Slope detector,Balanced slope detector, Foster-seely discriminator, ratio detector

Unit 5 : Noise **(06)**

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss's formula for Noise Figure, Noise Bandwidth. Behaviour of base band systems, DSBSC, SSBSC and AM in the presence of noise

Unit 6 : Pulse Analog modulation **(06)**

Multiplexing- FDM,TDM, Band limited and time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing and Aperture effect. Block diagram approach of PAM, PWM and PPM

Text Books:

1. B. P. Lathi, '**Modern Digital and Analog Communication Systems'**, *Oxford University Press,* (3rd Edition) ,(2003).
2. George Kennedy, '**Electronic Communication Systems**', *McGraw-Hill,* (5th Edition), (2013).

Reference Books:

1. Dennis Roddy and Coolen, '**Electronic Communication'**, *Prentice Hall,* (4th Edition), (2011).
2. R.P.Singh and S.D.Sapre, '**Communication Systems'**, *McGraw-Hill. (*3rd Edition), (2016).
3. Blake R.,'**Electronic Communication Systems'**, *Thomson Publication,* (2nd Edition), (2002).
4. Simon Haykin, '**Communication Systems'**, *John Wiley and Sons,(* 4th Edition), (2000).
5. Taub and Schilling, '**Principles of Communication Systems'**, *Tata McGraw-Hill,* (3rd Edition) (2012).
6. Frenzel, '**Principles of Electronic Communication Systems**', *Tata McGraw-Hill,* (3rd Edition), (2008).

Website:

1. https://onlinecourses.nptel.ac.in/noc17_ec11/preview

List of Tutorials:

1. Calculation of signal bandwidth, spectrum components and modulation index.
2. Calculation of power relationships in AM, Transmission efficiency of different modulation techniques.
3. Analysis of power saving in DSB-SC, SSB-SC systems.
4. Calculation of intermediate frequency, image frequency and IFRR in AM/FM receiver system.
5. Design of super heterodyne radio receiver system.
6. Calculation of modulation index, deviation ratio in FM,PM.
7. Calculation of noise power, SNR, Noise figure.
8. Analyse behaviour of AM,DSB,SSB in the presence of noise.
9. Calculation of nyquist rate, sampling frequency in Pulse Modulation system.

EC 2203 Integrated Circuits and Applications

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: 1 Hr/Week

Examination Scheme:
In-Semester: 50 Marks
End-Semester: 50 Marks
Credits: 4

Course Objectives:

1. Introduce the working principle of Op-Amp
2. Discuss characteristics of Op-Amp and explain practical limitations
3. Familiarize the students with linear and non-linear applications of Op-Amp
4. Introduce signal converters (A/D, D/A)
5. Explain the characterstics of active filters, oscillators and operating principles of PLL

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Explain the significance of internal stages to detremine the performance of general pupose Op-Amp
2. Interpret and calculate performance parameters of Op Amp
3. Design and analyze linear and non linear applications of Op Amp
4. Explain the operation and charecteristics of A/D and D/A converters and phase lock loop
5. Calculate performance parameters of A/D and D/A converters and phase lock loop
6. Design Op Amp based butterworth filters

Unit 1: OP-AMP Basics **(07)**

Block diagram of OP-Amp and significance of each block, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configuration, Methods for improving CMRR of Differential Amplifier, Need of level shifter, Output stage of Op-amp.

Unit 2 : OP-AMP Performance Parameters **(06)**

Symbol and ideal equivalent circuit of OP-Amp, DC characteristics: Offset Voltage, Bias current, Offset current, Thermal drift, AC characteristics: Slew rate, Rise Time, CMRR, Frequency characteristics. Ideal parameters and practical parameters of OP-AMP and their comparison, Frequency compensation.

Unit 3 : Linear Applications of OP-AMP **(08)**

Inverting and Non-inverting amplifier, Voltage follower, Summing amplifier, Difference Amplifier, Instrumentation Amplifiers, Instrumentation Amplifier Applications. Ideal integrator, errors in ideal integrator, practical integrator, design of practical integrator, Ideal differentiator, errors in ideal differentiator, practical differentiator.

Unit 4 : Non-linear Applications of OP-AMP **(08)**

Comparator, Characteristics of comparator, Applications of comparator, Schmitt trigger, Square wave generator, Triangular wave generator, Need of precision rectifier, Half wave and Full wave precision rectifiers.

Unit 5 : Signal Converters **(06)**

I to V and V to I converter, DAC: Characteristics, Specifications and Types, ADC: Characteristics, Specifications and Types.

Unit 6 : Active filters and PLL **(07)**

First order and second order Active LP Butterworth filter, Filter design and frequency scaling, Block diagram of PLL and its function, Applications of PLL.

Text books:

1. Ramakant A. Gaikwad, '**Op Amps and Linear Integrated Circuits**', *Prentice Hall,* (4th Edition), (2000).
2. George Clayton and Steve Winder, '**Operational Amplifiers**', *Newnes Publication,* (4th Edition), (2004).
3. Salivahanan and Kanchanabhaskaran, '**Linear Integrated Circuits**', *McGraw Hill Education,(*1st Edition), (2013).

Reference Books:

1. Sergio Franco, '**Design with Operational Amplifiers and Analog Integrated Circuits**', *McGraw Hill Education,* (3rd Edition), *(2002).*
2. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
   Sedra Smith, '**Microelectronic Circuits**', *Oxford Publications,* (5th Edition), *(2004*).
3. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
4. Sedra Smith, '**Microelectronic Circuits**', *Oxford Publications,* (5th Edition), *(2004*).
5. D. Roy Choudhury and S. B. Jain, **'Linear Integrated Circuits'**, *New age International publishers,* (2nd Edition), (2003).

Websites:

1. www.ti.com
2. www.nptel.ac.in

List of Tutorials :

1. Analyze differential amplifier circuits.
2. Calculate Op Amp Parameter.
3. Op-amp datasheet- Pin packages, Manufacturers, Technical specifications.
4. Design of integrator and differentiator.
5. Design of instrumentation amplifier.
6. Analyze an application based on Op - Amp.
7. Design of waveform generator.
8. Analyze phase-locked loop (PLL).

EC 2204 Object Oriented Programming

Teaching Scheme
Lecture: 3 Hours/Week

Examination Scheme
In Semester: 50Marks
End Semester: 50Marks
Credits: 3

Course Objectives:

1. Make the students familiar with the basic concepts and techniques of OOP paradigm
2. Understand C++ and Java as programming languages
3. Develop ability to program in C++ and Java

Course Outcomes:
After completion of course, students will be able to:

1. Explain the principles of Object Oriented Programming
2. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
3. Identify the basic program constructs in Java
4. Apply the concepts of multi-threading, inheritance, interface, exception handling and applets in Java

Unit 1: Introduction to Object Oriented Programming (07)
Principles of Object-Oriented Programming, Beginning with C++, Tokens, Expressions and Control Structures, Functions in C++.

Unit 2: Concepts of Object Oriented Programming with C++ (07)
Classes and Objects, Constructors and Destructors. Operator overloading, Inheritance and their types. Virtual functions and polymorphism

Unit 3: Java Fundamentals (07)
Java Evolution, Overview of Java Language, Constants, Variables, and Data Types, Operators and Expressions, Decision making.

Unit 4: Classes Methods and Objects in Java (07)
Classes, Objects and Methods, Arrays and Strings. Overloading methods, Recursion

Unit 5: Inheritance, packages and Interfaces (07)
Inheritance basics, constructors in derived class. Object class. Packages, access protection, importing packages. Interfaces: Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.

Unit 6: Multithreading, exception handling and Applets (07)

Introduction to multithreading: Introduction, creating thread and extending thread class. Concept of Exception handling, types of errors, multiple catch statements. Applets: Concept, difference between applets and applications. Life cycle of an applet, types of applets.

Text Books:

1. E Balagurusamy, 'Object Oriented Programming with C++ and Java', McGraw Hill Education (India) Pvt. Ltd., First Reprint 2013.
2. Herbert Schildt, Java: The Complete Reference, McGraw Hill, (7th Edition), (2007).

Reference books:

1. Robert Lafore, **"Object Oriented Programming using C++"**, *SAMS publishing*, (4th Edition),(2002).
2. E Balagurusamy, "**Programming with Java A Primer"**, *Tata McGraw Hill*, (3rd Edition), First Reprint 2007.

Website:

1. http://onlinecourses.nptel.ac.in/noc16-cs19.
2. nptel.ac.in/courses/106105153.

HS 2201-Principles of Economics and Finance

Teaching Scheme:
Lectures: 3 Hrs/Week
Tutorial: Nil

Examination Scheme:
In-Semester: **50** Marks
End-Semester: **50** Marks
Credits: 3

Course Objectives:

1. Enable students to acquire knowledge and develop an understanding of basic concepts and principles of Economics & Finance
2. Make students acquaint with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector
3. Sensitize students to the current economic issues of the nation
4. Develop an understanding of the role of institutions in the functioning of an economy
5. Enhance financial literacy of engineering students

Course Outcomes: Students will be able to :

1. Use the concept of Production Possibility Frontier curve to solve the the questions of What, How and for Whom for economics entities
2. Solve, with the help of Supply and Demand curves, the Equilibrium Price and Quantity for a product or service in various types of market structures
3. Analyze the performance of different business organizations using various ratios (profitability,liquidity and activity) and Break-even Analysis
4. Apply the Time Value of Money to evaluate various investment options available to individuals and firms
5. Examine current Fiscal and Monetary policies by understanding the objectives of Macro Economics
6. Apply knowledge of Economics and Finance to make personal financial decisions

Unit 1: Central Concepts Of Economics (6hrs)
Economics as a science of choice and scarcity, Microeconomics and Macroeconomics, Positive and Normative Economics, Basic Economic Problems, Economic Systems-Market, Command and Mixed Economies, Society's Technological Possibilities, Opportunity Cost, Efficiency.

Unit 2: Basic Elements of Supply and Demand (6hrs)
Concept of Demand- Demand Schedule and Curve, Law of Demand, Determinants of Demand, Concept of Supply- Supply schedule, Supply curve, Equilibrium of Supply and Demand, Market and Market Structures- Perfect Competition, Monopolistic Competition, Oligopoly, Duopoly and Monopoly.

Unit 3: Role and Environment of Managerial Finance (6hrs)
Role of Finance in business, Forms of business organizations, Goals of the firm, Capital structure-Debt and equity capital, Sources of finance, Time value of money, Risk and Return.

Unit 4: Economic Analysis and Costs **(6hrs)**

Cost Concepts- Fixed and Variable Cost, Marginal Cost, Average Cost, Total Cost, Opportunity Cost, Link between production and cost, Break even Analysis, Financial analysis of a business firm- Statement of Profit and Loss, Balance Sheet, Basic Ratios.

Unit 5: Overview of Macroeconomics **(6hrs)**

Tools to measure economic activity- GDP, Employment rate, Inflation & Consumer Price Index, Fiscal and Monetary policy.

Unit 6: Money and The Financial System **(6hrs)**

Evolution of money, Role and Functions of the Financial System, Indian Financial System, Personal financial strategies.

Text Books:

1. Paul A Samuelson, '**Economics'**, Indian Adaptation, Sudip Chaudhari,Anindya Sen, *Mc Graw Hill* ,(19th Edition), (2010).
2. Lawrence J Gitman, '**Principles of Managerial Finance'**, *Pearson,* (11th Edition),(2016).
3. K.K.Dewett, '**Modern Economic Theory'**, *S.Chand,* (22nd Edition), (2005).

Reference Books:

1. Thursen Gerald, '**Engineering Economics'**, *Prentice Hall,* (9th Edition), (2008).
2. D.M.Mithani, '**Managerial Economics'**, *Himalaya Publishing House,* (8th Edition), (2016).

Websites:

1. www.economicshelp.org
2. www.rbi.org

EC 2205 Analog Communication Lab

Teaching Scheme:

Practical: 2 Hrs/Week

Examination Scheme:

Practical: 25 Marks

Credit: 1

Course objectives:

1. Explain mechanism of AM, FM generation and detection
2. Explain use of spectrum analyzer
3. Measurement of performance characteristics of superheterodyne radio receiver
4. Explain generation of flat top and natural sampling

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Draw waveforms AM, FM and explain the spectrum of the same
2. Explain effect of changes in modulating and carrier signal parameters on spectrum of AM and FM
3. Analyze performance characteristics of superheterodyne radio receiver
4. Draw sampling waveforms and explain effect of sampling frequency on detection of PulseAmplitude Modulation

List of Experiments:

1. AM generation and calculation of modulation index with graphical and trapezoidal method
2. AM generation using class C amplifier and AM detection with simple and practical diode detector
3. DSB-SC generation and synchronous detection with balanced modulator
4. SSB generation and detection with phase shift method
5. FM generation with direct method and measurement of deviation ratio for different amplitudes of modulating signal
6. FM Detection using PLL
7. Measurement of performance characteristics of Superheterodyne AM Receiver
8. Generation and detection of pulse amplitude modulation (PAM)
9. Simulation of AM generation with suitable software
10. Simulation of FM generation with suitable software

EC 2206 Integrated Circuits and Applications Lab

Teaching Scheme:
Practical: 2 Hrs/Week

Examination Scheme:
In-Semester: 25 Marks

Credit: 1

Course Objectives:

1. To measure Op-Amp performance parameters and understand the difference between ideal and practical values for different ICs
2. To design and implement linear and non-linear applications of Op-Amp and verify the functionality

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Design, testi and troubleshoot the Op-Amp based circuits
2. Select an appropriate Op-Amp IC for given application
3. Design and construct the Op-Amp circuits and analyze their performance

List of Practicals

1. Verify virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Measure Op-Amp parameters and compare with the specifications: Input bias current, input offset current, input offset voltage, slew rate, CMRR.
3. Design, build and test integrator for given frequency fa.
4. Design, build and test three Op-Amp instrumentation amplifiers for typical application.
5. Build and test precision half and full wave rectifier.
6. Design, build and test Schmitt trigger and plot transfer characteristics.
7. Design, build and test square and triangular waveform generator.
8. Build and test 2 bit R-2R ladder DAC.

EC 2207 Object Oriented Programming Lab

Teaching Scheme
Practicals: 4 Hours/Week

Examination Scheme
Oral: 25 Marks
Credits: 2

Course Objectives:

1. Exposure to object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism
2. Implement, test and debug programs in the object-oriented paradigm.

Course Outcomes:

1. Apply the concepts of data encapsulation, inheritance and polymorphism in C++
2. Explain the basic program constructs in Java and apply the same.
3. Apply the concepts of multi-threading, inheritance, exception handling and applets in Java.

List of Experiments

Write a program in C++ :

1. To sort the numbers in an array using separate functions for read, display, sort and swap. Objective is to learn the concepts of input/output, functions and call by reference in C++.
2. To perform the following operations on Complex numbers: Add, subtract, multiply, divide, complex conjugate. The objective is to learn the concepts of classes and objects.
3. To implement a Stack. Design the class for stack and the operations to be performed on stacks using constructors and destructors.
4. To implement a database of people having different professions e.g. engineer, doctor, student etc. using the concept of multiple inheritance.
5. Write a program in Java:
   i) To find factorial of a number
   ii) To display first 50 prime numbers
   iii) To find sum and average of N numbers
6. To implement a calculator with simple arithmetic operations such as add, subtract, multiply, divide and factorial using switch case and other simple Java statements
7. To define a class rectangle with the data fields width, length, area and colour. Create two objects of rectangle and compare their area and colour.
8. To sort i) List of integers ii) List of names
9. To add two matrices. The objective is to learn arrays in Java.
10. To create a player class. Inherit the classes Cricket_Player, Football_Player and Hockey_Player from the class Player. Objective is to learn the concepts of inheritance in Java.
11. Write a Java program which uses TRY and CATCH for exception handling.
12. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
13. Create an Applet with three text fields and four buttons ADD, SUBTRACT, MULTIPLY and DIVIDE.