S. Y. B. Tech. Autonomy Structure

S. Y. B. Tech. Electronics & Telecommunication Engineering Semester – I										
Course Code	**Course Title**	**Teaching Scheme Hours/Week**			**Examination Scheme**				**Marks**	**Credit**
		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. Electronics & Telecommunication Engineering Semester – II										
Course Code	**Course Title**	**Teaching Scheme Hours/Week**			**Examination Scheme**				**Marks**	**Credit**
		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**

EC 2101 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

Prerequisite:

1. Basics of semiconductor physics, BJT construction and working, BJT as amplifier and its frequency response.

Course Objectives:

1. To introduce the characteristics, working principles as well as concept of load line and operating point of FETs for analyzing DC circuits.
2. To explain the concepts of employing simple models to represent non linear elements such as JFETs and MOSFETs.
3. To analyze JFET and MOSFET amplifiers and discuss general frequency response characteristics of amplifiers.
4. To introduce basic analog subcircuits used in ICs like current sink and source, current mirror, Inverter , active load .
5. To impart the knowledge of feedback and its effects on characteristics of amplifier.
6. To familiarise the students with audio power amplifiers using BJTs.

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

1. Analyze and design DC biasing circuits for JFET and MOSFET.
2. Analyze and design FET RC coupled amplifier using small signal model.
3. Explain the frequency response of transistorised RC coupled circuits.
4. Describe the working of subcircuits of like current sink and source, current mirror, Inverter, active load used in Ics.
5. Analyze and design negative feedback amplifiers and oscillators.
6. Analyze class A, clas B, class AB and class C power amplifiers and determine power efficiency of each.

Unit 1: JFET (07)
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 (08)
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 **(05)**

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: CMOS subcircuits **(06)**

MOSFET as a Switch, Diode/Active Resistor, Current sink and source, MOSFET Transmission Gate, CMOS Inverter, Voltage Transfer Characteristics of CMOS Inverter, CMOS logic gates.

Unit 5: Feedback Amplifiers and Oscillators **(08)**

Classification of amplifiers, feedback concept, General characteristics of negative feedback amplifiers, Feedback Topologies, Voltage series and current series feedback amplifiers using FET and their analysis, Barkhausen criterion, sinusoidal oscillators: RC Phase shift and LC oscillators, Crystal oscillators.

Unit 6: Power Amplifiers **(06)**

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.Boylestad, 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. Phillip E. Allen, Douglas R. Holberg, **'CMOS Analog Circuit Design'**, *Oxford,* (3rd Edition) (2012).
3. Millman , Halkias, **'Integrated Electronics- Analog and Digital Circuits and Systems'**, *Tata McGraw Hill,* (2nd Edition) (2010).
4. Adel S Sedra ,Kenneth Smith,**'Microelectronic Circuits'**, Oxford Press,(5th Edition) (2004)

List of Assignments:

1. To design biasing circuit for JFET.
2. To design JFET amplifier.
3. To analyze MOSFET amplifier.
4. To analyze multistage JFET amplifiers.
5. To analyze analog CMOS Subcircuit.
6. To construct logic gates using MOSFET.
7. To analyze voltage series / current series feedback amplifiers.
8. To design oscillator circuit.
9. To 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

Prerequisite:
1. Linear algebra and Matrix operations.
2. Integral Calculus.
3. Ordinary Differential Equations and Laplace transforms.

Course Objectives:
The objective of the course is to introduce the student to:
1. Fundamentals of Network simplification techniques.
2. Network Theorems.
3. Transient and steady state response.
4. Two-port network and filter design analysis.
5. Transmission lines.

Course Outcomes:
Having successfully completed this course, the student will be able to:
1. Find current and voltage in any element in network.
2. Apply graph theory to solve network equations.
3. Calculate the initial conditions of RL, RC circuits.
4. Analyze and design prototype LC filters and resistive attenuators.
5. Simplify two port networks.

Unit 1: Network Theorems (08)
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 : Graph Theory (06)
Graph Theory and Network Equations, Network graph, tree, co-tree and loops, Incidence matrix, Tie-set, cut-set matrix, Formulation of equilibrium equations in matrix form, solution of resistive networks.

Unit 3 :Resonance (06)
Frequency Selective Networks- Significance of Quality factor. Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity. Effect of generator resistor (Rg) on bandwidth and Selectivity, Magnification factor. Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity, Comparison and applications of series and parallel resonant circuits.

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 (Z_0) and Attenuation Constant (γ) in terms of circuit components. Properties of Asymmetrical Networks: Image Impedance and Iterative Impedance (L-Section only). 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 **(06)**

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

Unit 6 : Transmission Line **(06)**

Transmission Line Theory, Types of Transmission lines, Transmission Line Equation, Equivalent circuits, Primary and Secondary line constants, Terminations of transmission lines, VSWR and Reflection Coefficient.

Text Books:

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

Reference Books:

1. John D. Ryder, '**Network Lines and Fields**', *PHI Publications.*
2. M. E. Van Valkenburg, **'Network Analysis**', *PHI / Pearson Education*, 3rd Edition. Reprint 2002.
3. Franklin F. Kuo, '**Network analysis and Synthesis',** *Wiley International Edition.*

List of Assignments:

1. Problems on Mesh, Nodal analysis. Source transformation and source shifting.
2. Problems on Network Theorems
3. Problems on Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form, solution of resistive networks and principle of duality.
4. Problems on Series Resonance Circuits.
5. Problems on Parallel resonant circuits.
6. To find Z0 and γ Symmetrical Networks (T and only) in terms of circuit components. To find Asymmetrical Networks: Image Impedance and Iterative Impedance (L-Section only).
7. Designing of Constant K-LPF, HPF, BPF and BSF.
8. To find out Z, Y, h, ABCD parameters 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

Prerequisite:

1. Basic Electronics Engineering.
2. Knowledge of Boolean Algebra and number systems.

Course Objectives:

1. To introduce reduction methods for simplification of Boolean function.
2. To make students familiar with combinational circuits using basic logic gates and MSI chips.
3. To introduce flip-flops, counters, their functionality and applications.
4. To educate students with sequential circuits using flip-flop and counters.
5. To introduce Programmable Logic Devices and their architectures.
6. To make students familiar with logic families.

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

1. Apply reduction techniques to design basic combinational circuits.
2. Analyze combinational circuits using gates and MSI chips.
3. Design counters using flip-flops.
4. Analyze sequential and combinational circuits.
5. Analyze combinational circuits using Programmable Logic Devices.
6. Compare digital logic families.

Unit 1 : Combinational Logic Design (08)
Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (up to 4 variables), don't care conditions. Design Examples: Arithmetic Circuits, code converters. Adders and their use as a sub tractor, ALU, Digital Comparator, Parity Generators/checkers.

Unit 2 : Combinational Logic Design using MSI chips (07)
Multiplexers and their use in combinational logic designs, multiplexer trees, Demultiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees. Circuit design using adder, comparator ICs.

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 counters, Sequence generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitters and their effect on synchronous designs.

Unit 4 : State Machines (06)

Mealy and Moore machines representation. Design of state machines using State diagram, State table, State reduction, State assignment. Finite state machine implementation, Sequence detector.

Unit 5 : Digital Logic Families (08)

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,Interfacing CMOS and TTL. Comparison between TTL, CMOS technologies.

Unit 6 : Programmable Logic Devices (06)

Programmable logic devices: Internal architecture, Study of PROM, PAL, PLA, Designing Combinational circuits using PLDs. General architecture of FPGA and CPLD.

Text Books:

1. R.P. Jain, **'Modern digital electronics'**, *TMH Publication,* (3rd edition), (2007).
2. Anand Kumar, **'Fundamentals of digital circuits**', *PHI Publication*, (1stedition),(2001).

Reference Books:

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

List of Assignments:

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. Flip- Flop conversion.
6. Design mod-N asynchronous and synchronous counters.
7. Design sequence generator using shift register.
8. Design logic function using PLA.

EC 2104 Data Structures

Teaching Scheme:
Lectures: 3 Hrs/Week

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

Prerequisite:
1. Basic Knowledge of C programming language

Course Objectives:
1. Introduction to the theory, practice and methods of data structures.
2. To introduce elementary data structures such as Arrays, Linked lists and model other data structures.
3. To learn modelling of linear data structures like stacks and queues.
4. To learn modelling of non-linear data structures like trees and graphs.

Course Outcomes:
After completion of course, students will be able to-
1. Select and apply the data structures that in effectively model the information in a problem.
2. Calculate the computational efficiency of the principal algorithms.
3. Implement, test and debug programs.

Unit 1 : Introduction, Arrays and 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 and 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 and Structures in C (07)
Pointers: Basic concepts. Pointer declaration and 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 and 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 **(05)**

Stacks: Definition and example, representation using arrays and linked list. Applications of Stacks: Concept of infix, postfix and prefix expressions, conversion of infix to postfix expression, evaluation of postfix expression. Queues: Definition and 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 and 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 and BFS. Minimal spanning tree: Kruskal, Prim's algorithm.

Text Books:

1. Seymour Lipschutz, '**Data Structure with C',** *Schaum's Outlines, Tata McGrawHill,* (2004).
2. E Balgurusamy, '**Programming in ANSI C**', *Tata McGraw-Hill*, (3rd Edition), (2008).

Reference Boks:

1. Richard F. Gilbergand Behrouz A. Forouzan, '**Data Structures A Pseudocode Approach with C**', *Cengage Learning*, (2nd edition) (2005).
2. YedidyahLangsam, 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).

Web References:

1. www.nptel.iitm.ac.in
2. www.cs.auckland.ac.nz

BSEC 2101 Engineering Mathematics III

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs/Week	In-Semester: 50 Marks
Tutorial: 1 Hr/Week	End-Semester: 50 Marks
	Credits: 4

Prerequisite:

1. Basics of integral and multiple integral.
2. Beta function , Gamma function.
3. Partial fractions.
4. First order linear differential equation.
5. Basics of vector algebra, basics of solid Geometry.

Course Objectives:

1. To make the students familiar with the concepts of Fourier and Z-transforms, LDE, Vector analysis, complex analysis.
2. To understand different mathematical methods for solving Higher order LDE, to understand the concepts of Vector differentiation, vector integration and complex analysis.
3. To educate the students to analyze and apply these methods to solve Engineering problems.

Course Outcomes:

The student will be able to:

1. Formulate Fourier and Z-transforms, LDE, Vector analysis, complex analysis.
2. Relate the concepts of Fourier and Z-transforms, LDE, Vector analysis, Complex analysis with Electronics Engineering Applications.
3. Apply the Fourier and Z-transforms techniques, methods of solving LDE, Vector analysis, complex analysis to solve problems.
4. Compare and analyze the methods for solving LDE, Vector calculus, Fourier and Z-transforms, complex variables.

Unit 1 : Fourier Transform **(06)**

Complex exponential form of Fourier series, Fourier integral theorem, sine and cosine integrals, Fourier transform, Fourier Sine and Cosine transform, Inverse Fourier Transform.

Unit 2 : Z- Transform **(06)**

Definition, standard properties, Z- Transform of standard sequences, Inverse Z – Transform using standard results, Inversion integral method, solution of difference equation.

Unit 3 : Higher Order Linear Differential equation and application **(09)**

Higher order Linear differential Equation with constant coefficients, Cauchy's and Legendre's Differential Equations, Simultaneous Differential Equations, Modeling of electrical circuits.

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 **(09)**

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

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 Student Edition), (2004).

EC 2105 Electronic Devices and Circuits Lab

Teaching Scheme: Practical: 4 Hrs/Week

Examination Scheme: Practical: 25 Marks
Credits: 2

Course objectives:

1. To build circuits and take measurements of circuit variables using tools such as oscilloscopes, multimeters, and signal generators.
2. To compare the measurements with the behavior predicted by mathematic models and explain the discrepancies.
3. To 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. Relate the mathematical representation of circuit behavior with corresponding real-life effects.
3. Design, implement and analyze electronic circuits like amplifier, switch, oscillator.
4. Verify the electronic circuits using simulation tool.

Tools and Platforms: Multisim 11.0

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. Study the effect of different capacitors on bandwidth of amplifier.
7. Plot V-I characteristics of MOSFET.
8. Implement logic gates using MOSFET.
9. Plot voltage transfer characteristics of CMOS inverter.
10. Simulate current mirror circuit.
11. Implement differential amplifier (beyond syllabus).
12. Implement Voltage Series Feedback Amplifier.
13. Implement Current Series Feedback Amplifier.
14. Simulate LC Oscillator.
15. Implement Power Amplifier.
16. Implement driver circuit for different types of loads(beyond syllabus).

EC 2106 Digital Electronics Lab

Teaching Scheme: Practical: 2 Hrs/Week

Examination Scheme: In-Semester: 25 Marks

Credits: 1

Course Objectives:

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

Course Outcomes:

After completion of practical, students will be able to-

1. Identify the functionality of ICs as a multiplexer, flip-flops and counters.
2. Design basic digital building blocks such as multiplexer, flip-flops and shift registers.
3. Implement and test digital circuits and verify the truth tables.
4. Use the software tools for the design and 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 MOD-N asynchronous Binary counter using counter ICs.
7. Design and implement 4 bit counter using preset-table Synchronous counter IC.
8. Verify different modes of shift register IC and design and implement pulse train generator using 4 bit shift register.
9. Write and simulate VHDL code for D FF using synchronous and asynchronous reset input.
10. Write and simulate VHDL code for 4 bit logical and arithmetic operations for ALU.

EC 2107 Data Structures Lab

Teaching Scheme: Practical: 4 Hrs/Week

Examination Scheme: Oral: 50 Marks

Credits: 2

Course Objectives:

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

Course Outcomes:

On completion of the course, student will be able to-

1. Calculate the computational efficiency of the principal algorithms such as sorting and searching.
2. Explain how arrays, records, linked structures are represented in memory and use them in algorithms.
3. Implement stacks and queues for various applications.
4. Apply terminologies and traversals for trees and graphs and use them for various applications.

Tools and Platforms: Compiler - gcc

List of Experiments:

Write C program to implement-

1. Sorting methods – bubble, selection and insertion.
2. Searching techniques- linear and binary.
3. Perform following String operations with and without pointers to arrays (without using the library functions): a. substring, b. palindrome, c. compare, d. copy, e. Reverse.
4. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.
5. Polynomial addition using array of structure.
6. 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.
7. Accept input as a string and construct a Doubly Linked List for the input string with each node contains, as a data one character from the string and perform:
   a. Insert b. delete, c. Display forward, d. Display backward.
8. Implement Stack using arrays. Perform following operations on stack a. Push b. Pop c. Display.
9. Implement Stack using Linked Lists. Perform following operations on stack a. Push b. Pop c. Display.
10. Evaluation of postfix expression (input will be postfix expression).
11. Implement Queue using arrays. Write a menu driven program to perform following operations on Queue a. Insert b. Delete c. Display.
12. Implement Queue using Linked Lists. Write a menu driven program to perform following operations on Queue a. Insert b. Delete c. Display.
13. Binary search tree: Create, search, recursive traversals.
14. Graph using adjacency Matrix with BFS and DFS traversals.
15. Represent graph using adjacency list or matrix and generate minimum spanning tree using Prim's algorithm.
16. 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

Prerequisite:

1. Basic knowledge of mathematical operations like trigonometric formulae's, integration, summation and partial fractions.

Course Objectives:

1. To introduce basic signals and operations on signals.
2. To learn systems, types and their analysis.
3. To introduce the concept of Fourier transform and its applications.
4. To make students familiar with the concept of correlation and spectral density.
5. To 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 (09)

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 (09)

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 - III: System Analysis using Fourier analysis (07)

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-IV: 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- V – Probability and Random Variables **(07)**

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, Raleigh, Binomial, Poisson's.

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).

Web Reference:

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

List of Assignments:

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 integral on continuous time Signals.
5. Perform convolution sum on discrete time Signals.
6. Analyse the given LTI system using impulse response.
7. Apply the concept of Fourier Transform on time domain signals.
8. Perform auto and cross correlation for DT and CT signals.
9. Evaluate ESD and PSD of CT signals.
10. Apply concepts of CDF, PDF and Statistical averages
11. MATLAB/C assignment on signal operations.

EC 2202 Analog Communication

Teaching Scheme	**Examination Scheme**
Lecture: 3 Hrs/Week	In-Semester: 50 Marks
Tutorial: 1 Hrs/Week	End-Semester: 50 Marks
	Credits: 4

Prerequisite:

1. Knowledge of classification of basic signals.

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.
2. Explain the basic concepts of Amplitude and Angle Modulation-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 (07)

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 **(07)**

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 **(05)**

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 **(05)**

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 **(05)**

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*, 3rdEdition (2008).

List of Assignments:

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 modulation index, deviation ratio in FM,PM.
5. Design of super heterodyne radio receiver system.
6. Calculation of intermediate frequency, image frequency and IFRR in AM/FM receiver system.
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

Prerequisite:
1. Knowledge of basics of Electronic devices and circuits

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:
After completion of course, students will be able to-
1. Describe the internal stages of Op-Amp ICs.
2. List the desired performance characteristics of Op-Amp and illustrate their significance in various applications.
3. Design and analyze Op-Amp based amplifiers, comparators.
4. Explain the operation of the most commonly used A/D and D/A converter types and their applications.
5. Analyze and design active filters, oscillators and PLL based applications.

Unit 1: OP-AMP Basics (06)
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 and types 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, Voltage scaling, Difference Amplifier, Requirements of Instrumentation Amplifier, OP-Amp Instrumentation Amplifiers, Instrumentation Amplifier Applications. Summing amplifier, Ideal integrator, errors in ideal integrator, practical integrator, design of practical integrator, frequency response of practical integrator, applications of integrator. Ideal differentiator, errors in ideal differentiator, practical differentiator, frequency response of practical differentiator, applications of differentiator.

Unit 4 : Non-linear Applications of OP-AMP **(06)**

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, Sample and hold circuit.

Unit 5 : Signal Converters and Oscillators **(08)**

I to V and V to I converter, DAC: Characteristics, Specifications and Types, ADC: Characteristics, Specifications and Types, Oscillators principle, types and frequency stability, design of phase shift, wein bridge, voltage controlled oscillators. .

Unit 6 : Active filters and PLL **(06)**

First order and second order Active LP, HP 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,* (2013).

Reference Books:

1. Sergio Franco, '**Design with Operational Amplifiers and Analog Integrated Circuits'**,
2. *McGraw Hill Education, (3rd Edition), (2002).*
3. **Texas Instruments Op-amp Book – Op-Amp for Everyone**: Design Reference.
4. Sedra Smith, '**Microelectronic Circuits**', *Oxford Publications, (5th Edition), (2004*).
5. Govind Daryanani, '**Principles of Active Network Synthesis and Design**', *J. Wiley and Sons, (2009).*
6. 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 Assignments :

1. Op-amp datasheet- Pin packages, Manufacturers, Technical specifications.
2. Analysis of differential amplifier circuits.
3. Design of integrator, differentiator, Instrumentation amplifier.
4. Implementation of a mathematical equation using op-amp circuits.
5. Design an application based system using comparator.
6. Design of waveform generator.
7. Interfacing of ADC with microcontroller.
8. Design of phase-locked loop (PLL).

EC 2204 Object Oriented Programming

Teaching Scheme
Lecture: 3 Hrs/Week

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

Prerequisite:

1. Basic Knowledge of C programming language

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. Use the concepts and philosophy of Java to write programs in Java.

Unit 1 : Introduction to Object Oriented Programming (08)
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, Inheritanceand 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 (05)
Classes, Objects and Methods, Arrays and Strings. Overloading methods, Recursion.

Unit 5 : Inheritance, packages and Interfaces **(05)**
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 **(06)**

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, **'Programming with C++'**,*Tata McGraw Hill, 3rd edition.*
2. Herbert Schildt, '**Java: The complete reference'**, *Tata McGraw Hill, 7th edition.*

Reference Books:

1. Robert Lafore, "**Object Oriented Programming in C++**", *SAMS publishing, 4th edition.*

2. E Balagurusamy, '**Programming with Java A Primer'**, *Tata McGraw Hill, 3rd edition*.
3. H.M.Dietel and P.J.Dietel, **"Java How to Program"** , *Pearson Education/PHI, 6th edition.*

HS 2201-Principles of Economics and Finance

Teaching Scheme: | **Examination Scheme:**

Lectures: 3 Hrs/Week | In-Semester: 50 Marks

Tutorial: Nil | End-Semester: 50 Marks

Credits: 3

Course Objectives:

1. To enable students to acquire knowledge and develop an understanding of basic concepts and principles in Economics & Finance.
2. To 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. To sensitize students to the current economic issues of the nation.
4. To develop an understanding of the role of institutions in the functioning of an economy.
5. To enhance financial literacy of engineering students.

Course Outcomes:
Students will be able to :

1. Identify problems faced by economic organisation.
2. Compare role of demand and supply to reach market equilibrium.
3. Examine the role & functions of finance in business organizations
4. Understand basic economic &financial tools to measure performance of business organization and country.
5. Apply her knowledge of economics and finance to make personal financial decisions.

Unit I: Central Concepts Of Economics **(6)**

Economics as a study of choice, scarcity, way of thinking. Microeconomics and Macroeconomics, Positive & Normative Economics, Three problems of Economic organization, Market, command and Mixed Economies, Society's Technological Possibilities, Opportunity Costs, Efficiency, Adam Smith's contribution to Economics.

Unit II: Basic Elements of Supply & Demand **(6)**

Demand Schedule &Curve, Law of Demand, Determinants of Demand, Supply schedule, Supply curve, Equilibrium of supply and Demand, Demand and consumer behaviour, market and market structures.

Unit III: Role and Envirornment of Managerial Finance **(6)**

Finance & business, Forms of business organizations, finance functions, relationship of finance with economics, goal of the firm, capital structure, Debt and equity capital, sources of finance, basic concepts of Interest and capital, Time value of money, risk and return.

Unit IV: Economic Analysis And Costs **(6)**

Fixed and variable cost, marginal cost, average cost, link between production and cost, Break even Analysis, Statement of Profit and Loss, balance sheet, basic ratios.

Unit V: Overview of Macroeconomics **(6)**

Tools to measure economic activity, GDP, Employment rate, Inflation & Consumer price Index, Fiscal & monetary policy.

Unit VI: Money And The Financial System **(6)**

Role & Functions of the Financial System, special case of money, banks & the supply of money, stock market, India's Financial Institution, Essential elements of central banking, Personal financial strategies.

Text Books:

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

Reference Books and websites:

1. Thursen Gerald, Engineering Economics, Prentice Hall. (9th edition, 2008)
2. V. Mote, S. Paul, G. Gupta, **Managerial Economics**, *Tata McGraw Hill.*(2004)
3. D.M.Mithani,**Managerial Economics**, *Himalaya Publishing House* (8th edition,2016)

Website:

1. *www.khanacademy.org*

EC 2205 Analog Communication Lab

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs/Week	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:

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 Pulse Amplitude Modulation.

Tool and Platforms: MATLAB/Scilab.

List of Experiments:

1. AM generation and calculation of modulation index with graphical and trapezoide 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:
After completion of course, students 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 Experiments
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. Build and test 2 bit R-2R ladder DAC.
8. Design, build and test square and triangular waveform generator.

EC 2207 Object Oriented Programming Lab

Teaching Scheme:
Practicals: 4 Hrs/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. Use the concepts and philosophy of Java to write programs in Java.

Tool and Platforms: g++ compiler, open JDK, Eclipse

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.

Write a program in Java-

5. To find factorial of a number
6. To display first 50 prime numbers
7. To find sum and average of N numbers
8. To implement a calculator with simple arithmetic operations such as add, subtract, multiply, divide and factorial using switch case and other simple Java statements.
9. 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.
10. To sort i) List of integers ii) List of names
11. To add two matrices. The objective is to learn arrays in Java.
12. 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.
13. Write a Java program which uses TRY and CATCH for exception handling.
14. Write a program to implement stack or any other data structure in Java
15. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
16. Create an Applet with three text fields and four buttons ADD, SUBTRACT, MULTIPLY and DIVIDE.