## Autonomous Program Structure of
Second Year B. Tech. Third Semester
(Electronics and Telecommunication Engineering)
**Academic Year: 2021-2022 Onwards**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Scheme Hours /Week</th>
<th>Examination Scheme</th>
<th>Total Marks</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
<td>In Sem</td>
</tr>
<tr>
<td>20BSEC301</td>
<td>Calculus and Probability (C&amp;S)</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>20EC301</td>
<td>Electronic Circuits and Applications (ECA)</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>20EC302</td>
<td>Signals and Systems (SS)</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>20EC303</td>
<td>Data Structures and Algorithms (DSA)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>20HS301</td>
<td>Universal Human Values-2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>20EC301L</td>
<td>Electronic Circuits and Applications Lab (ECA Lab)</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>20EC303L</td>
<td>Data Structures and Algorithms Lab (DSA Lab)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>20AC301</td>
<td>Audit Course (AC)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>14</td>
<td>4</td>
<td>7</td>
<td>300</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td>25</td>
<td>550</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>
20BSEC301  CALCULUS AND PROBABILITY

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hour / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 4

Prerequisite: 20BS01 Linear Algebra and Univariate Calculus, 20BS03 Multivariate Calculus

Course Objectives:
1. To familiarize the students with various techniques in Calculus and Probability
2. To equip the students to deal with advanced level of Mathematics and applications that would be essential for their disciplines
3. To introduce concept of Probability and Probability distribution to analyze problems

Course Outcomes:
After completion of the course, students will be able to
CO1 Determine the Probability of various events using suitable probability distribution
CO2 Solve higher order Linear Differential Equations and analyze its solution
CO3 Find the complex form of Fourier series
CO4 Identify and apply suitable properties to find mathematical transforms and solve initial value problems
CO5 Use Vector differentiation and Vector integration to find physical quantities like work done and flux across the surfaces

Unit I: Probability and Probability Distributions (08)

Unit II: Higher Order Linear Differential Equation and Applications (07)
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 Differential Equation, Applications to L-R-C circuit, Forced response, Natural response.

Unit III: Complex Fourier series and Fourier Transform (08)
Unit IV: Laplace Transform

Definition of Laplace and Inverse Laplace transform, Properties and Theorems, Laplace Transform of standard functions, Laplace Transform of some special functions viz. Periodic, Heaviside unit step, Unit impulse and Ramp function, Inverse Laplace Transform, Initial value problems.

Unit V: Vector Differential Calculus

Physical interpretation of vector differentiation, Vector differential operator, Gradient, Divergence, Curl, Directional derivative, Scalar potential, Vector identities.

Unit VI: Vector Integral calculus

Line integral, Surface integral, Work done, Green’s Lemma, Gauss’ Divergence Theorem, Stokes Theorem.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Transform Calculus and its Applications in Differential Equations”
   https://nptel.ac.in/courses/111/105/111105123/
2. NPTEL Course "Probability Theory and Applications"
   https://nptel.ac.in/courses/111/104/111104079/
20EC301 ELECTRONIC CIRCUITS AND APPLICATIONS

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hours / Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks

Credits: 4

Prerequisite: 20ES01: Basic Electrical and Electronics Engineering

Course Objectives:
1. To understand semiconductor devices such as JFET and MOSFET, Its characteristics, Parameters and its applications
2. To understand Operational amplifier, Concept, Parameters and applications
3. To understand Linear and non-linear applications of Op-Amp
4. To understand Characteristics of Active filters and Operating principles of PLL

Course Outcomes:
After completion of the course, students will be able to
CO1 Interpret the characteristics of JFET and MOSFET
CO2 Analyze parameters of JFET and MOSFET towards its application as an Amplifier
CO3 Illustrate the significance of internal stages of Op-Amp, Interpret and calculate performance parameters of Op Amp and PLL
CO4 Design and Analyze Linear and Nonlinear applications of Op Amp and Butterworth filters

Unit I: JFET
Introduction, Types, Construction of JFET, Characteristics (Transfer and Drain) and working of JFET, Sheckley's equation, JFET biasing and DC analysis, JFET as an amplifier and its configurations (CS/CD/CG), CS amplifier analysis.

Unit II: MOSFET
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, Breakdown effect, Temperature effect, Subthreshold conduction), MOSFET biasing and DC circuit analysis, MOSFET small signal amplifier (CS configuration).

Unit III: Op-Amp Basics

Unit IV: Linear Applications of Op-Amp
Inverting and Non-inverting amplifier, Voltage follower, Summing amplifier, Difference amplifier, Instrumentation amplifier, Ideal integrator, Errors in ideal integrator, Practical integrator, Ideal differentiator, Errors in ideal differentiator, Practical differentiator.
Unit V: Non-Linear Applications of Op-Amp (07)
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 VI: Active Filters and PLL (06)
First order and second order active LP Butterworth filter, Filter design and frequency scaling, Block diagram of PLL, Characteristics of PLL, Applications of PLL.

Text Books:

Reference Books:

Online Resources:
1. https://www.ti.com
2. NPTEL Course “Analog Electronic Circuits”
   https://nptel.ac.in/courses/108/105/108105158/
3. NPTEL Course on “Analog Circuits”
   https://nptel.ac.in/courses/108/101/108101094/
20EC302 SIGNALS AND SYSTEMS

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hour/Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks

Credits: 4

Prerequisite: 20BS01 Linear Algebra and Univariate Calculus, 20BS03 Multivariate Calculus

Course Objectives:
1. To represent continuous and discrete time signals and systems mathematically
2. To classify signals and systems into different categories
3. To analyze Linear Time Invariant (LTI) systems in time and transform domains
4. To make students familiar with the concept of Correlation and Spectral Density

Course Outcomes:
After completion of the course, students will be able to
CO1 Classify basic Signals and Systems on the basis of characteristics
CO2 Perform operations on Signals and identify Systems
CO3 Apply convolution theorem to find the response of the Linear Time Invariant (LTI) system
CO4 Analyze signals and systems using Fourier Transform and Z Transform
CO5 Apply the concepts of correlation and spectral density on Continuous Time and Discrete Time signals

Unit I: Introduction to Signals
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 aperiodic, Deterministic and random, Energy and power, Operations on signals: Amplitude scaling, Time scaling, Time shifting and Folding, Precedence rule, Addition, Multiplication, Differentiation, Integration, Elementary signals: Impulse and its properties, Step, Ramp, Exponential, Sine, Rectangular, Triangular, Signum and Sinc.

Unit II: System Classification

Unit III: Fourier Transform
Overview of CTFS and CTFT, Introduction to DTFT and properties, Inverse Fourier transform, Applications of FT.
Unit IV: Z Transform (07)

Unit V: Correlation and Spectral Density (06)
Definition of Correlation and Spectral Density, Correlogram, Analogy between correlation and convolution, Auto-correlation and Cross correlation for CT and DT signals and their relationship with energy / power spectral densities.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Signals and Systems”
   https://nptel.ac.in/courses/117101055/
Course Objectives:
1. To recall the primitive data types, concepts of logic building and problem solving
2. To understand data representation, implementation and applications of linear and non-linear data structures
3. To learn and apply different algorithms on different types of data structures
4. To learn the concept and understand the importance of time and space complexity

Course Outcomes:
After completion of the course, students will be able to
CO1 Classify and categorize data structures that make up for a programming language
CO2 Infer to the modelled data structures from the premise of the baseline models
CO3 Apply algorithms on linear and non-linear data structures for performing different operations on data
CO4 Categorize the choice of data structures and its memory allocation on the basis of data definition, data access and manipulation

Unit I: Introduction to Data and Data Structures (07)
Concepts and definition of Data, Data type, Data object, Data structures, Searching Methods: Algorithms for Sequential Search, Indexed Sequential Search and Binary Search, Sorting Methods: Algorithms for Selection sort, Bubble sort, Insertion sort, Quick sort, Merge sort, Introduction to Time complexity and Space complexity, Brief overview of the Big Oh and other notations as performance metrics for the algorithms.

Unit II: Pointers, Structures and Functions in C (07)
Pointers: Basic concepts, Pointer declaration and initialization, Scale factor, Pointer to a pointer, Pointers and arrays, Structures in C: Concept, Comparison with arrays as a data structure, Array of Structures, Pointers and Structures, Concept of ordered list and polynomial representation using array of structures.
Functions: Type of functions and their categories, Parameter passing by value, Parameter passing by reference, Recursive functions, Bitwise Operators.

Unit III: Linked Lists (07)
Concept of Lists, Single 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, Abstract Data Type (ADT), List as an ADT, Generalized Linked List (GLL): Concept, Parenthesized enumeration, Representation of multivariable polynomials using GLL.
Unit IV: Modeled Data Structures - Linear (07)
Stacks: Definition and example, Representation using arrays and linked list, Applications of Stacks: Concept of infix, Postfix and Prefix expressions, Algorithm to convert infix expression to a postfix expression, Algorithm to evaluate a 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 V: Modeled Data Structures – Non Linear (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 VI: Modeled Data Structures – Non Linear (Graphs) (07)
Graphs: Concepts and terminology, Types of graphs: Directed graph, Undirected graph, Planar graph, Representation of graph using adjacency matrix, Adjacency list, Traversals: Depth First Search (DFS) and Breadth First Search (BFS). Minimal Spanning Tree (MST): Kruskal’s algorithm, Prim’s algorithm, Algorithm to find the shortest path: Dijkstra's algorithm.

Text Books:

Reference Books:

Online Resources:
1. NPTEL Course “Programming, Data Structures and Algorithms using C”
   https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/
20HS301 UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Teaching Scheme
Lectures: 2 Hours / Week
Tutorial: 1 Hour/Week

Examination Scheme
ISE: 50 Marks
ESE: 50 Marks
Credits: 3

Prerequisite: Nil

Course Objectives:
1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:
After completion of the course, students will be able to
CO1 Understand human values which is only the solution of most of the present-day problems and a sustained solution could emerge only through understanding of value-based living
CO2 Compare desires of ‘I’ and ‘Body’ distinctly. If any desire appears related to both, students are able to see that the feeling is related to I while the physical facility is related to the body
CO3 Develop Natural acceptance (intention) which is always for living in harmony which leads to fulfillment in relationships.
CO4 Understand the whole existence to see the interconnectedness in the Nature
CO5 Make use of sustainable solutions to the problems in the society and the Nature

Module 1 Introduction to Value Education
Understanding Value Education: Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility: Happiness and Prosperity – Current Scenario: Method to Fulfill the Basic Human Aspirations.

Module 2 Harmony in the Human Being
Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health.
Module 3  Harmony in the Family and Society  (06)
Harmony in the Family – the Basic Unit of Human Interaction: Values in Human-to-Human Relationship - 'Trust' the Foundational Value in Relationship, 'Respect' as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order.

Module 4  Harmony in the Nature/Existence  (04)

Module 5  Implications of the Holistic Understanding – a Look at Professional Ethics  (06)

Text Books:

Reference Books:
20EC301L ELECTRONICS CIRCUITS AND APPLICATIONS LAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
ISE: 25 Marks
ESE: Practical: 25 Marks
Credits: 2

Course Objectives:
1. To identify and characterize the device such as JFET and MOSFET.
2. To measure Op-Amp performance parameters and understand the difference between ideal and practical values for different ICs.
3. To design and implement linear and non-linear applications of Op-Amp and verify the functionality

Course Outcomes:
After completion of the course, students will be able to
CO1 Interpret characteristics of JFET and MOSFET
CO2 Design biasing circuits for JFET amplifier and analyze performance of JFET amplifier
CO3 Select an appropriate Op-Amp IC for given application and analyze their performance
CO4 Design Op-Amp based circuits and analyze their performance

List of Experiments:
1. Plot V-I characteristics of JFET.
2. Implement biasing circuits for JFET and verify DC operating point.
3. Implement JFET CS amplifier and calculate $A_V$, $R_i$, and $R_o$.
4. Plot V-I characteristics of MOSFET.
5. Measure Op-Amp parameters and compare with the ideal specifications:
   - Input bias current,
   - Input offset current,
   - Input offset voltage,
   - Slew rate,
   - CMRR.
6. Design, Build and Test Integrator for given frequency $f_a$.
7. Design, Build and Test three Op-Amp Instrumentation amplifier for typical application.
8. Design, Build and Test Schmitt trigger and plot transfer characteristics.
9. Design, Build and Test Square and Triangular waveform generator.
10. Build and Test half and full wave precision rectifier.
11. Simulate JFET CG and CD amplifier.
12. Simulate and verify virtual ground and virtual short concept in inverting and non-inverting configuration of Op-Amp.
13. Simulate and verify the response of Differentiator for given frequency $f_a$.
14. Simulate and verify the response of 1st and 2nd order Butterworth low pass filter.
15. Build and Test a small project using Op-Amp IC or suitable discrete components.
20EC303L DATA STRUCTURES AND ALGORITHMS LAB

Teaching Scheme  
Lectures: 2 Hours / Week

Examination Scheme  
ISE: 25 Marks  
ESE: Practical:25 Marks  
Credits: 1

Course Objectives
1. To recall the concepts of procedural programming language paradigm  
2. To understand the significance of data structures and its use  
3. To understand and implement data searching and sorting methods  
4. To understand and implement algorithms for solving given problems

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

CO1 Utilize the principal algorithms of sorting and searching on the given data  
CO2 Implement basic linear data structures like arrays, records and linked lists  
CO3 Analyze the requirement and implement stacks and queues from the base models  
CO4 Build, represent and traverse non-linear data structures

List of Experiments:
1. Write a program to reorder the data using sorting techniques like: bubble, selection, insertion, quick and merge sort.  
2. Write a program to locate data using sequential and binary search techniques.  
3. Create a database of students using an array of structures with attributes; roll no., name, program, course, marks obtained for different subjects with their total and average. Implement the following operations on the database:  
   a) Display the database in a tabular form.  
   b) Modify (should be able to modify each field of the database).  
   c) Append (add a new record to the existing database).  
   d) Search for a particular record from the database.  
   e) Sort the records in the database.  
4. Write a program to add two polynomials using array of structures. The display should include the polynomials that are added and the resultant polynomial in descending order of the exponents.  
5. Write a program to create a singly linked list using dynamic memory allocation functions. Implement the following operations on the linked list:  
   a) Display.  
   b) Insert a node in the linked list (at front, at end, in the middle).  
   c) Delete a node from the linked list (at front, at end, in the middle).  
   d) Display the linked list in reverse.  
   e) Revert the linked list.  
6. Write a program to model an array as a stack (Static implementation of Stack) and perform the following operations on it:  
   a) Push  
   b) Pop  
   c) Display
7. Write a program to model a singly linked list as a stack (Dynamic implementation of Stack) and perform the following operations on it:
   a) Push
   b) Pop
   c) Display
8. Write a program to evaluate a postfix expression using a stack. The input expression should be a postfix one.
9. Write a program to model an array as a queue (Static implementation of Queue) and perform the following operations on it:
   a) Add
   b) Delete
   c) Display
10. Write a program to model a linked list as a queue (Dynamic implementation of Queue) and perform the following operations on it:
    a) Add
    b) Delete
    c) Display
11. Create a Binary Search Tree and perform the following operations on it:
    a) Recursive traversals on the tree (display elements of the tree).
    b) Search a node in the tree.
12. Create a graph and represent it using an adjacency matrix. Implement BFS and DFS traversals.