

**SEMESTER III**

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1.	MA3355	Random Processes and Linear Algebra	BSC	3	1	0	4	4
2.	CS3353	C Programming and Data Structures	ESC	3	0	0	3	3
3.	EC3354	Signals and Systems	PCC	3	1	0	4	4
4.	EC3353	Electronic Devices and Circuits	PCC	3	0	0	3	3
5.	EC3351	Control Systems	PCC	3	0	0	3	3
6.	EC3352	Digital Systems Design	PCC	3	0	2	5	4
<b>PRACTICALS</b>								
7.	EC3361	Electronic Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
8.	CS3362	C Programming and Data Structures Laboratory	PCC	0	0	3	3	1.5
9.	GE3361	Professional Development <sup>§</sup>	EEC	0	0	2	2	1
<b>TOTAL</b>				<b>18</b>	<b>2</b>	<b>10</b>	<b>30</b>	<b>25</b>

<sup>§</sup> Skill Based Course

**SEMESTER IV**

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1.	EC3452	Electromagnetic Fields	PCC	3	0	0	3	3
2.	EC3401	Networks and Security	PCC	3	0	2	5	4
3.	EC3451	Linear Integrated Circuits	PCC	3	0	0	3	3
4.	EC3492	Digital Signal Processing	PCC	3	0	2	5	4
5.	EC3491	Communication Systems	PCC	3	0	0	3	3
6.	GE3451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7.		NCC Credit Course Level 2 <sup>#</sup>		3	0	0	3	3 <sup>#</sup>
<b>PRACTICALS</b>								
8.	EC3461	Communication Systems Laboratory	PCC	0	0	3	3	1.5
9.	EC3462	Linear Integrated Circuits Laboratory	PCC	0	0	3	3	1.5
<b>TOTAL</b>				<b>17</b>	<b>0</b>	<b>10</b>	<b>27</b>	<b>22</b>

<sup>#</sup> NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

MA3355

RANDOM PROCESSES AND LINEAR ALGEBRA

L T P C

3 1 0 4

**COURSE OBJECTIVES :**

- To introduce the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To provide necessary basics in probability that are relevant in applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

**UNIT - I PROBABILITY AND RANDOM VARIABLES 9 + 3**

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

**UNIT - II TWO - DIMENSIONAL RANDOM VARIABLES 9 + 3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT – III RANDOM PROCESSES 9 + 3**

Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) - Limiting distributions .

**UNIT - IV VECTOR SPACES 9 + 3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

**UNIT - V LINEAR TRANSFORMATION AND INNER PRODUCT SPACES 9 + 3**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES :**

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

CO1: Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.

CO2: Demonstrate accurate and efficient use of advanced algebraic techniques.

CO3: Apply the concept of random processes in engineering disciplines.

CO4: Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.

CO5: Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

**TEXTBOOKS :**

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi, 4<sup>th</sup> Edition, 2004.

**REFERENCE BOOKS :**

1. Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
4. Kolman. B. Hill. D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
5. Kumaresan. S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
6. Strang. G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.

**CS3353**

**C PROGRAMMING AND DATA STRUCTURES**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To introduce the basics of C programming language.
- To learn the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.
- To know the concepts of non-linear data structure and hashing.
- To familiarize the concepts of sorting and searching techniques.

**UNIT I C PROGRAMMING FUNDAMENTALS (8+1 SKILL)**

**9**

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

**UNIT II C PROGRAMMING - ADVANCED FEATURES (8+1 SKILL)**

**9**

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.

**UNIT III LINEAR DATA STRUCTURES (8+1 SKILL)**

**9**

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – Doubly-Linked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Priority Queues – Queue Implementation – Applications.

**UNIT IV NON-LINEAR DATA STRUCTURES (8+1 SKILL)**

**9**

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

**UNIT V SORTING AND SEARCHING TECHNIQUES (8+1 SKILL) 9**

Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

**TOTAL 45 PERIODS**

**SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) 5**

**COURSE OUTCOMES:**

**CO1:**Develop C programs for any real world/technical application.

**CO2:**Apply advanced features of C in solving problems.

**CO3:**Write functions to implement linear and non-linear data structure operations.

**CO4:**Suggest and use appropriate linear/non-linear data structure operations for solving a given problem.

**CO5:**Appropriately use sort and search algorithms for a given application.

**CO6:**Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

**TEXT BOOKS:**

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
2. Reema Thareja, "Programming in C", Second Edition, Oxford University Press, 2016.

**REFERENCES:**

1. Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 1999.
2. Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.

**List of Open Source Software/ Learning website:**

<https://www.coursera.org/specializations/data-structures-algorithms>

<https://nptel.ac.in/courses/112107243>

<https://nptel.ac.in/courses/112105598>

**EC3354**

**SIGNALS AND SYSTEMS**

**L T P C**

**3 1 0 4**

**COURSE OBJECTIVES :**

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS**

**6+6**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids\_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals -Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

**UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS**

**6+6**

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

**UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS**

**6+6**

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

**UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS**

**6+6**

Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

**UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS**

**6+6**

Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

**TOTAL: 30+30 PERIODS**

**COURSE OUTCOMES:**

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

CO1:determine if a given system is linear/causal/stable

CO2: determine the frequency components present in a deterministic signal

CO3:characterize continuous LTI systems in the time domain and frequency domain

CO4:characterize continuous LTI systems in the time domain and frequency domain

CO5:compute the output of an LTI system in the time and frequency domains

**TEXT BOOKS:**

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.(Units I - V)
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002

**REFERENCES :**

1. B. P. Lathi, "Principles of Linear Systems and Signals", 2<sup>nd</sup> Edition, Oxford, 2009.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

**EC3353**

**ELECTRONIC DEVICES AND CIRCUITS**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES :**

- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

**UNIT I SEMICONDUCTOR DEVICES 9**

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

**UNIT II AMPLIFIERS 9**

Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.

**UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9**

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response – Neutralization methods.

**UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9**

Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

**UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS 9**

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

**www.binils.com** TOTAL: 45 PERIODS

**COURSE OUTCOMES :**

At the end of the course the students will be able to

CO1: Explain the structure and working operation of basic electronic devices.

CO2: Design and analyze amplifiers.

CO3: Analyze frequency response of BJT and MOSFET amplifiers

CO4: Design and analyze feedback amplifiers and oscillator principles.

CO5: Design and analyze power amplifiers and supply circuits

**TEXT BOOKS :**

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008.
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7 th Edition, 2014.

**REFERENCES :**

1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3 rd Edition, 2010.
2. D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, 3 rd Edition, 1989
3. Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.

EC3351

CONTROL SYSTEMS

L T P C  
3 0 0 3

**COURSE OBJECTIVES :**

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

**UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9**

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

**UNIT II TIME RESPONSE ANALYSIS 9**

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems

**UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9**

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

**UNIT IV CONCEPTS OF STABILITY ANALYSIS 9**

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

**UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9**

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

**TOTAL:45 PERIODS**

**COURSE OUTCOMES :**

**Upon successful completion of the course the student will be able to**

CO1: Compute the transfer function of different physical systems.

CO2: Analyse the time domain specification and calculate the steady state error.

CO3: Illustrate the frequency response characteristics of open loop and closed loop system response.

CO4: Analyse the stability using Routh and root locus techniques.

CO5: Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.

**TEXT BOOK:**

1. M.Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4<sup>th</sup> Edition, 2012.

**REFERENCE:**

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5<sup>th</sup> Edition, 2007.
2. K.Ogata, "Modern Control Engineering", PHI, 5<sup>th</sup> Edition, 2012.
3. S.K.Bhattacharya, "Control System Engineering", Pearson, 3<sup>rd</sup> Edition, 2013.
4. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7<sup>th</sup> Edition, 1995.

**EC3352**

**DIGITAL SYSTEMS DESIGN**

**L T P C**

**3 0 2 4**

**COURSE OBJECTIVES :**

- To present the fundamentals of digital circuits and simplification methods
- To practice the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits
- To learn integrated circuit families.
- To introduce semiconductor memories and related technology

**UNIT I BASIC CONCEPTS**

**9**

Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, implementation of Boolean expressions using universal gates , Tabulation methods.

**UNIT II COMBINATIONAL LOGIC CIRCUITS**

**9**

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit, Parity Generator/Checker, Seven Segment display decoder

**UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS**

**9**

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment, lock - out condition circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock

**UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS**

**9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits.

**UNIT V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES**

**9**

Logic families- Propagation Delay, Fan - In and Fan - Out - Noise Margin - RTL ,TTL,ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basic memory, static ROM,PROM,EPRM,EEPROM EAPROM.



**PRACTICAL EXERCISES :**

1. Design of adders and subtractors & code converters.
2. Design of Multiplexers & Demultiplexers.
3. Design of Encoders and Decoders.
4. Design of Magnitude Comparators
5. Design and implementation of counters using flip-flops
6. Design and implementation of shift registers.

**COURSE OUTCOMES :**

At the end of the course the students will be able to

CO1: Use Boolean algebra and simplification procedures relevant to digital logic.

CO2: Design various combinational digital circuits using logic gates.

CO3: Analyse and design synchronous sequential circuits.

CO4: Analyse and design asynchronous sequential circuits. .

CO5: Build logic gates and use programmable devices

**TOTAL:75 PERIODS**

**TEXTBOOKS :**

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 5th Edition, 2013.(Unit - I -V)

**REFERENCES :**

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merrill publishing company, 1982.
4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4 th Edition, 2007.

**EC3361**

**ELECTRONIC DEVICES AND CIRCUITS LABORATORY**

**L T P C**  
**0 0 3 1.5**

**COURSE OBJECTIVES**

- To learn the characteristics of PN Junction diode and Zener diode.
- To understand the operation of rectifiers and filters.
- To study the characteristics of amplifier.

**LIST OF EXPERIMENTS**

1. Characteristics of PN Junction Diode and Zener diode.
2. Full Wave Rectifier with Filters.
3. Design of Zener diode Regulator.
4. Common Emitter input-output Characteristics.
5. MOSFET Drain current and Transfer Characteristics.
6. Frequency response of CE and CS amplifiers.
7. Frequency response of CB and CC amplifiers.
8. Frequency response of Cascode Amplifier
9. CMRR measurement of Differential Amplifier
10. Class A Transformer Coupled Power Amplifier.

### COURSE OUTCOMES

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

**CO1:**Characteristics of PN Junction Diode and Zener diode.

**CO2:**Design and Testing of BJT and MOSFET amplifiers.

**CO3:**Operation of power amplifiers.

**TOTAL:45 PERIODS**

### LAB REQUIREMENTS

1. CRO/DSO (30 MHz) – 15 Nos.
2. Signal Generators / Function Generators (3 MHz) – 15 Nos.
3. Dual Regulated Power Supplies (0-30 v) - 15 Nos.
4. Bread Boards - 15 Nos.
5. BC107, BC547, BF195C, BFW10, IN4001, IN4007 – 25 each
6. SPICE Simulator

### REFERENCE :

XYZ of Oscilloscope – Application note: Tektronix USA.

**CS3362            C PROGRAMMING AND DATA STRUCTURES LABORATORY            L T P C**  
**0 0 3 1.5**

### COURSE OBJECTIVES:

- To develop applications in C
- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To get familiarized to sorting and searching algorithms

### LIST OF EXPERIMENTS

1. Practice of C programming using statements, expressions, decision making and iterative statements
2. Practice of C programming using Functions and Arrays
3. Implement C programs using Pointers and Structures
4. Implement C programs using Files
5. Development of real time C applications
6. Array implementation of List ADT
7. Array implementation of Stack and Queue ADTs
8. Linked list implementation of List, Stack and Queue ADTs
9. Applications of List, Stack and Queue ADTs
10. 10.Implementation of Binary Trees and operations of Binary Trees
11. Implementation of Binary Search Trees
12. Implementation of searching techniques
13. Implementation of Sorting algorithms : Insertion Sort, Quick Sort, Merge Sort
14. Implementation of Hashing – any two collision techniques

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

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

**CO1:**Use different constructs of C and develop applications

**CO2:**Write functions to implement linear and non-linear data structure operations