ASSAM DON BOSCO UNIVERSITY
DETAIL SYLLABUS
PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA)

Semester	SL No	Course Code	Course Name	Credit
FIRST SEMESTER	1	CACL100T	Computer Programming in C Language (Theory)	2
		CACL101L	Computer Programming in C Language (Lab)	2
	2	CALE104T	Cyber Law and Ethics	4
	3	CACF106L	Computer Fundamentals	3
	4	MTFB107T	Fundamentals of Business, Management & Economics	3
	5	CBES101T	Environmental Studies	2
	6	CACE109T	Service Learning	2
	7	AECH100T	Business Communication	2
			TOTAL CREDIT	**20**
SECOND SEMESTER	1	CADS102T	Data Structures Using C (Theory)	3
		CADS103L	Data Structures Using C (Lab)	1
	2	CAET105T	E-commerce Technologies	4
	3	CAHS107L	Hardware and Server Maintenance	3
	4	AECE100T	Communicative English I	2
	5	MTIE108T	Indian Economy	3
	6	CBDT103T	Digital and Technological Solutions	1
	7	CBUI104T	Understanding India	1
	8	CESL102P	Service-Learning Practice	2
			TOTAL CREDIT	**20**

Semester	Category	Course Code	Course Name	Credit
THIRD SEMESTER	1	CAIJT200T	Introduction to Java Programming (Theory)	3

		CAIJ201L	Introduction to Java Programming (Lab)	1
	2	CALD202T	Digital Logic Design (Theory)	3
		CALD203L	Digital Logic Design (Lab)	1
	3	CAER210T	Enterprise Resource Planning	4
	4	CAMG214L	Multimedia and Graphics	3
	5	CESL103P	Service-Learning Practice	2
	6	MTEI109T	Emotional Intelligence	3
				20
FOURTH SEMESTER	1	CAOS204T	Operating System (Theory)	3
		CAOS205L	Operating System (Lab)	2
	2	CACA206T	Computer Organization and Architecture (Theory)	3
		CACA207L	Computer Organization and Architecture (Lab)	2
	3	CARD208T	Relational Database Management Systems (Theory)	3
		CARD209L	Relational Database Management Systems (Lab)	1
	4	CAWD211T	Basics of Web Designing (Theory)	3
		CAWR212L	Basics of Web Designing (Lab)	1
	5	AECE201T	Communicative English II	2
			TOTAL CREDIT	**20**
Semester	**Category**	**Course Code**	**Course Name**	**Credit**
FIFTH SEMESTER	1	CACN300T	Computer Network Fundamentals (Theory)	3
		CACN301L	Computer Network Fundamentals (Lab)	2
	2	CAWT302T	Web Technologies (Theory)	3
		CAWT303L	Web Technologies (Lab)	2
	3	CASE304T	Software Engineering (Theory)	3
		CASE305L	Software Engineering (Lab)	1
	4	CAPT310T	Basics of Python (Theory)	2
		CAPT311L	Basics of Python (Lab)	2
	5	CAIN314I	Internship	2
			TOTAL CREDIT	**20**
SIXTH SEMESTER	1	CACC306T	Cloud Computing	4
	2	CAAD307T	Android Application Development Fundamentals	4

	3	CANS308T	Network Security	4
	4	CAPW309P	Minor Project	4
	5	CABS312T	Business Statistics	4
	TOTAL CREDIT			**20**
	Grand Total Credit			**120**

DEPARTMENT OF COMPUTER APPLICATIONS
PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA)

VISION
Impart knowledge of Computer Applications to mould individuals into IT professionals, researchers, and entrepreneurs who are innovative, versatile and committed to society.

MISSION
- To prepare students for professional careers and higher studies by providing conducive teaching, learning, and research environment.
- To produce skilled individuals and entrepreneurs in emerging areas of technologies through academia-industry collaboration.
- To instill in individuals a sense of commitment to work for the betterment of society using technology.

PROGRAM OUTCOMES - BCA
PO 1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO 3: Social Interaction: Elicit views of others, mediate disagreements, and help reach conclusions in group settings.
PO 4: Effective Citizenship: Demonstrate empathetic social concern and equity-centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO 7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes
PO 8: Innovation and Entrepreneurship: Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES – BCA
PSO 1: Knowledge of Computing Systems: An ability to understand the principles and workings of computer systems.
PSO 2: Project Development Skills: An ability to understand the structure and development methodologies of software systems.
PSO 3: Software Development Skills: Familiarity and practical competence with a broad range of programming languages and open-source platforms.
PSO 4: Research Skills: Ability to enhance research skills by utilizing standard research-based tools for analysis, design, and implementation of techniques for resolving real-life and/or social problems.

LIST OF COURSES -BCA

1.1	CACL100T: Computer Programming in C Language (Theory)
1.2	CACL101L: Computer Programming in C Language (Lab)
1.3	CALE104T: Cyber Law and Ethics
1.4	Computer Fundamentals
2.1	CADS102T: Data Structures Using C (Theory)
2.2	CADS103L: Data Structures Using C (Lab)
2.3	CAET105T: E-commerce Technologies
2.4	Hardware and Server Maintenance
3.1	CAIJ200L: Introduction to Java Programming (Theory)
3.2	CAIJT201T: Introduction to Java Programming (Lab)
3.3	CALD202T: Digital Logic Design (Theory)
3.4	CALD203L: Digital Logic Design (Lab)
3.5	CAER210T: Enterprise Resource Planning

3.6	Multimedia and Graphics
4.1	CAOS204T: Operating System (Theory)
4.2	CAOS205L: Operating System (Lab)

4.3	CACA206T: Computer Organization and Architecture (Theory)
4.4	CACA207L: Computer Organization and Architecture (Lab)
4.5	CARD208T: Relational Database Management Systems (Theory)
4.6	CARD209L: Relational Database Management Systems (Lab)
4.7	CAWD211T: Basics of Web Designing (Theory)
4.8	CAWR212L: Basics of Web Designing (Lab)
5.1	CACN300T: Computer Network Fundamentals (Theory)
5.2	CACN301L: Computer Network Fundamentals (Lab)
5.3	CAWT302T: Web Technologies (Theory)
5.4	CAWT303L: Web Technologies (Lab)
5.5	CASE304T: Software Engineering (Theory)
5.6	CASE305L: Software Engineering (Lab)
5.7	CAPT310T: Basics of Python (Theory)
5.8	CAPT311L: Basics of Python (Lab)
5.9	Internship
6.1	CACC306T: Cloud Computing
6.2	CAAD307T: Android Application Development Fundamentals
6.3	CANS308T: Network Security
6.4	CAPW309P: Minor Project
6.5	CABS312T: Business Statistics

POs and PSOs mapping

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	H							L		M	H	M
1.2	H							L		M	H	M
1.3	M							M	H	M	H	H
1.4		H					L		H			
2.1	H							L		M	M	
2.2	H							L		M	M	
2.3	M	H		L				M				
2.4							L	L				
3.1	H							L		M	H	M
3.2	H							L		M	H	M
3.3	M								H			
3.4	M								H			
3.5	L	M						H				

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
3.6	L	M					H	M	M	H	L	H
4.1	L								H	L	M	
4.2	L								H	L	M	
4.3	L								H	L		M
4.4	L								H	L		M
4.5	L							L		H	M	
4.6	L							L		H	M	
4.7		M		M				H		M	M	
4.8		M		M				H		M	M	
5.1	M				L	L	H	H	H	M		H
5.2		M	L		M	M	H	H	H	M	M	H
5.3		M		M				H		M	M	
5.4		M		M				H		M	M	
5.5	M				M	H	H	H	H	H	M	M
5.6	L				M	M	H	H	H	H	M	M
5.7	M							H		H	H	M

5.8	M							H		H	H	M
5.9	H	H					M	H	M	H	H	H
6.1	M								H	M	L	
6.2	M								H	H	H	
6.3	H				M		M		M	M	M	H
6.4	H	M	H	M	M	H	H	M	M	H	H	H
6.5	H							M	M		L	M

DETAILED
SYLLABUS MAJOR
COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CACL100T	Computer Programming in C Language (Theory)	2
		CACL101L	Computer Programming in C Language (Lab)	2
2	Major Course 2	CADS102T	Data Structures Using C (Theory)	3
		CADS103L	Data Structures Using C (Lab)	1
3	Major Course 3	CAIJT200T	Introduction to Java Programming (Theory)	3
		CAIJ201L	Introduction to Java Programming (Lab)	1
3	Major Course 4	CALD202T	Digital Logic Design (Theory)	3
		CALD203L	Digital Logic Design (Lab)	1
4	Major Course 5	CAOS204T	Operating System (Theory)	3
		CAOS205L	Operating System (Lab)	2
4	Major Course 6	CACA206T	Computer Organization and Architecture (Theory)	3
		CACA207L	Computer Organization and Architecture (Lab)	2
4	Major Course 7	CARD208T	Relational Database Management Systems (Theory)	3
		CARD209L	Relational Database Management Systems (Lab)	1
5	Major Course 8	CACN300T	Computer Network Fundamentals (Theory)	3
		CACN301L	Computer Network Fundamentals (Lab)	2
5	Major Course 9	CAWT302T	Web Technologies (Theory)	3
		CAWT303L	Web Technologies (Lab)	2
5	Major Course 10	CASE304T	Software Engineering (Theory)	3
		CASE305L	Software Engineering (Lab)	1
6	Major Course 11	CACC306T	Cloud Computing	4
6	Major Course 12	CAAD307T	Android Application Development Fundamentals	4
6	Major Course 13	CANS308T	Network Security	4
6	Major Course 14	CAPW309P	Minor Project	4

CACL100T: COMPUTER PROGRAMMING IN C LANGUAGE
(2 credits – 30 hours) (L-T-P: 2-0-0)

Objective:
The objective of the course is to learn the concept of C programming language and to solve the problem statement using the C language.

COURSE / LEARNING OUTCOMES
At the end of this course, students will be able to:
CO 1: Define information based on the understanding of the concepts of C language's syntax, data types, control statements,
      functions, pointers, arrays, structures and pointers in C. (Understanding)
CO 2: Solve problems using standard algorithms, translate pseudo-codes into C programs, and implement them. (Applying)
CO 3: Evaluate the data structure, function, data types, and algorithms used for searching, sorting, solving problem instances, etc. in terms of correctness and computation cost. (Evaluating)
CO 4: Combine the various concepts and ideas learned in C to plan, propose, and develop a product. (Creating)

Module I: Introduction to Algorithms and Programming Languages (8 hours)
Introduction to structured programming and problem-solving methods: algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages.
Overview of C: introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants, and variables, I/O statements, operators, and expressions, precedence and associativity of operators, type conversion, and typecasting.

Module II: Decision Control Statements, Loops and Functions (8 hours)
Decision Control Statements and Loops: Introduction to Decision Control Statements, Conditional Branching statements, while loop, do-while loop, for loops, Nested Loops, Break and Continue Statements
C Functions: Need for functions, function declaration and definition, user defined and library functions, passing

parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays, Strings and Pointers (8 hours)

Arrays and Strings: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays and string operations.

Pointers: Introduction to pointers, pointer expressions, dynamic memory allocation.

Module IV: Structures and Unions (6 hours)

Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types.

Suggested Readings

1. Thareja, R., Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Gottfried, Byron S., Programming with C (Schaum's Outlines Series), Tata McGraw Hill Publishing Company Limited, New
   Delhi.
3. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, Prentice Hall Pvt. Ltd, New Jersey.

E Resources

1. NPTEL SWAYAM Course on- Introduction To Programming In C- By Prof. Satyadev Nandakumar, IIT Kanpur
2. NPTEL SWAYAM Course on- Problem-Solving Through Programming In C, By Prof. Anupam Basu, IIT Kharagpur
3. C Programming - Learn Computer Programming With C Language, Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	L	H	H	M
CO 3	H	H	M	M
CO 4		M	H	H

CACL101L: COMPUTER PROGRAMMING IN C LANGUAGE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective

The objective of the course is to learn how to solve problems using c programming language.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Interpret information based on their understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures and pointers in C. (Understanding)

CO 2: Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)

CO 3: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analysing)

List of experiments:

1. Introduction to OS: Linux/Unix, Vi editor, file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions
3. If else
4. Switch-case statements
5. Break, continue
6. Loops
7. Single and multidimensional arrays
8. Functions and recursion
9. Pointers, address operator, declaring pointers and operations on pointers

Suggested Readings

1. Balagurusamy, E., Computer Fundamentals and C Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Kanetkar, Y., Let us C, BPB Publication, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	L	M	L	L	L	H	H	H	H
CO 2			L	L	L	H	M	H	H

CO 3	L	M	M	M	H	H	H	H	H

CADS102T: DATA STRUCTURES USING C
(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective
The objective of the course is to learn how to create data structures to represent a collection of similar data and solve problems using C language.

COURSE / LEARNING OUTCOMES
At the end of this course, students will be able to:
CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)
CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)
CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying) CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Module I: Arrays and Lists (13 Hours)
Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types, Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication).
Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form).

Module II: Stacks and Queues (12 Hours)
Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks: Conversion of infix (containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression.

Module III: Trees and Graphs (10 Hours)
Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non- recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), Height balanced (AVL) binary trees (construct and traverse an AVL tree), B-tree (construction and traversal of a B-tree of given order) Introducing Graphs; Graph representation: Adjacency matrix, adjacency lists, incidence matrix; Traversal schemes: Depth first search, Breadth first search

Module IV: Searching and Sorting (10 Hours)
Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Basic Sorting algorithms.

Suggested Readings
1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata
   McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

E Resources
1. NPTEL SWAYAM Course on- Data Structure using C Programming, By Dr. Dipti Verma and Mr. Aditya Tiwari, Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)
2. Data Structures and Algorithms In C (DSA) by Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3			H	M
CO 4		M	M	H

CADS103L: DATA STRUCTURES USING C Lab
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:

CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)

CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)

CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying)

CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Solution of problems on-
1. Arrays
2. Stacks and Stack Application, Queues
3. Linked Lists, Circular and Doubly Linked Lists
4. Binary Trees
5. Searching and data modification: Linear search, Binary search, Hashing
6. Sorting Techniques: Selection, Insertion, Bubble Sort.

Suggested Readings
1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M			M	M
CO 2	M	H			H	H
CO 3	M		H	M		
CO 4		M	M	H	M	M

CAIJ200T: INTRODUCTION TO JAVA PROGRAMMING
(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective
The course is designed to impart the knowledge and skill required to solve real-world problems using an object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5).

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:

CO 1: Recall the knowledge of the structure and model of the Java programming language, (Remembering)

CO 2: Explain the use of Java programming language for various programming technologies (Understanding) CO 3: Develop software in the Java programming language. (Applying)

CO 4: Analyse user requirements for software functionality required to decide whether the Java programming language can meet user requirements. (Analysing)

CO 5: Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (Evaluating)

CO 6: Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (Creating)

Module I: Java Fundamentals (16 hours)
Genesis, Java Philosophy, Java & Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL), Tokens, Expressions, Using Data Types, Declarations, Control Flow

Module II: Java Classes, Packages and Interfaces, Java Streams (14 hours)
1. Introduction, Classes, Working with Objects, Packages, Inheritance, Interfaces

2. Data Flow with Java Streams, Input Streams, Output Streams

Module III: Exception Handling in Java and Java threads (10 hours)
1. Introduction, Exception Methods, java.lang Exceptions
2. Introduction, Creating Threads, the Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads

Module IV: Java Applets (10 hours)
Introduction, Applet Examples, The java.applet.Applet Class, The Five Stages of an Applet's Life Cycle, Methods for Adding UI
Components, Methods for Drawing and Event Handling

Module V: Java AWT (10 hours)
Introduction, Swing Component and Container classes, Layout managers (Flow Layout, Grid Layout, Border Layout), Handling events, Adapter classes, Anonymous inner classes, Swing GUI components :JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame, introduction to database connectivity with JDBC.

Suggested Readings
1. Deitel, H. M.; P. J. Deitel, Java: How to Program, New Delhi: Prentice Hall India
2. Schildt, H., The Complete Reference Java 2, New Delhi: Tata McGrawHill
3. Moss, K., Java Servlets, New Delhi Tata McGraw-Hill
4. Russell, Java Programming for the absolute Beginner, New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell, New Delhi: O' Reilly

E Resources
1. Coursera course on Introduction to Java
2. Udemy Course on Java Programming for Complete Beginners

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	M			
CO 3		M	M	M	M
CO 4		M	M	M	M
CO 5		M	M	M	M
CO 6		M	M	M	M

CAIJ201L: Introduction to Java Programming Lab
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.(Remembering/Evaluating)
CO 2: Write Java application programs using OOP principles and proper Program structuring. (Applying/Understanding) CO 3: Demonstrate the concepts of polymorphism and inheritance .(Applying)
CO 4: Write Java programs to implement error handling techniques using exception handling.(Applying) CO 5: Analyse the real world problems and solve using Java programming .(Analysing/ Applying)

List of Experiments
1. Java Fundamentals using Data Types, Declarations, Control Flow
2. Java Classes and Java Packages
3. Java Interfaces and Java Streams
4. Java Exception Handling
5. Java Threads

6. Java Applets
7. Java AWT

E-resource for learning
1. Java, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	H					
CO 2	M	M	M	M			
CO 3			M				
CO 4				H			

CO 5					M	M	M

CALD202T: DIGITAL LOGIC DESIGN
(3 credits–45 hours) (L-T-P) (2-1-0)

Objectives

This course covers the basic concepts of digital logic. The course includes the fundamental concepts of Boolean algebra and its application for circuit analysis, multilevel gates networks, flip-lops, counters logic devices and synchronous and asynchronous sequential logic and digital integrated circuits.

COURSE / LEARNING OUTCOMES

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

CO 1: To solve conversion among different number systems (Applying)

CO 2: Apply the knowledge of Boolean algebra, Karnaugh-map or tabulation method to minimises Boolean expressions. (Applying)

CO 3: Design and analyse a given combinational/ sequential circuit and determine the corresponding truth table/ state table. (Analysing)

Module I: Number Systems (6 Hours)

Binary, Octal, & Hexadecimal Number Systems and Their Conversions, Representation of Signed Numbers-Floating Point Number, Binary Arithmetic, Representation-of BCD-ASCII-Excess 3 -Gray Code —Error Detecting and Correcting Codes.

Module II: Boolean Algebra, Simplification of Boolean Functions (13 Hours)

Boolean Algebra: Various Boolean operations; Postulates, Theorems, Duality, Boolean functions, Canonical forms, Representation of Boolean expressions using truth tables, logic gates. Boolean expressions minimization using Karnaugh map, Realization of canonical forms from Karnaugh map, Don't Care Conditions - problems using Don't care conditions, benefit of using Don't care conditions. Tabulation method/Quine- Mc Kluskey method, prime implicants.

Module III: Combinational Logic and Sequential Logic (26 Hours)

Digital devices: Logic gates, wired-logic, 8 non-degenerate forms of NOR and NAND, multilevel NAND and NOR gats, buffer, 3- state buffer, high impedance state, Realization of other logic functions using NAND/NOR gates. Drawing logic diagrams for different types of Boolean expression derived from truth tables; A brief introduction to Combinational and sequential circuits. Difference between Combinational and sequential circuits; Arithmetic circuits: Half-adder, Full-adder, Binary Adder, Binary Parallel Adder, BCD Adder, Binary Adder-Subtractor, Half-subtractor, Binary Incrementer, carry propagation, look ahead carry, carry generator, magnitude comparator; Encoders, Decoders, Multiplexers, Demultiplexers

Flip-flops: Different types of flip-flops, Flip-flop excitation tables, characteristic equations, truth tables, Triggering of Flip-flops. Registers: Registers (Register with Parallel Load), Shift registers

Counters: Asynchronous counters, Synchronous counters; Binary Counter with Par-allel Load, binary Ripple Counter, BCD ripple counter, synchronous binary counter, binary count-up-down counter, BCD synchronous counter.

Suggested Readings

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources

1. SWAYAM course on Digital System Design By Prof. Neeraj Goel, IIT Ropar
2. SWAYAM Course on Digital Circuits by Prof. Santanu Chattopadhyay, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	M
CO 3			H

CALD203L: DIGITAL LOGIC DESIGN LAB
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of the experiments students will be able to:

CO 1: Explain the working of the various logic gates. (Understanding)

CO 2: Experiment with different logic gates to solve any given problem. (Applying) CO 3: Analyse a given logic circuit and point out errors in it. (Analysing)

CO 4: Evaluate the output of a logic circuit for given inputs. (Evaluating)

List of experiments-
1. *Study of the Truth tables of logic gates*
2. *Realization of half/full adder and half/full adder subtractor*
3. *Verify truth table of multiplexer and demultiplexer*
4. *Verify truth table of one bit and four bit comparators*
5. *Verify truth table of flip-flops*
6. *Simulation with VDHL*
7. *Adders*
8. *Subtractors*
9. *Logic gates*
10. *MUX and DEMUX*

Suggested Readings:
1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources
1. SWAYAM course on Digital Logic and Circuits Simulations by Prof. Awadhesh Kumar, Banaras Hindu University

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M		
CO 3			M	M	H	H
CO 4			M	M	M	H

CAOS204T: OPERATING SYSTEMS
(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective
To provide the basic functionalities and services provided by an operating system. This subject provides an overview of process management, memory management, deadlock, file system, input-output systems and protection and security. It gives knowledge on existing common operating systems like UNIX, Linux and Windows.

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Define the basic concepts of operating systems and terminology related to operating systems such as processes, threads, files, semaphores, IPC abstractions, shared memory regions. (Remembering)
CO 2: Analyze important algorithms such as Process scheduling and memory management algorithms. (Analysing)
CO 3: Categorize the operating system's resource management techniques, deadlock management techniques, memory management techniques. (Analysing)
CO 4: Discuss and examine the importance of File and I/O system management in operating systems. (Evaluating)

Module I: Introduction to Operating systems (5 Hours)

Definition of Operating Systems, Functions of Operating Systems, Types of Operating Systems: Batch, Multiprogram med, Time sharing, Multi-Processor, Real-time and Distributed Operating Systems, Operating System Structures, Components and Services, System calls.

Module II: Process Management (10 Hours)
Process Concept-Definition, Process States, Process Control Block, Process Schedulers- Short term, Medium term and Long term schedulers, Scheduling Algorithms - Preemptive and Non-Preemptive, Co-operating process, Threads, Inter-process communication.

Module III: Process Synchronization and Deadlock (12 Hours)
Process Synchronization-the Critical Section Problem, Classical Problems of Synchronization, Semaphores. Deadlocks - Definition of a Deadlock, System model, Characterization, Deadlock Handling-Prevention, Avoidance, Detection and Recovery (Banker's Algorithms and Resource Request Algorithm

Module IV: Memory Management (10 Hours)
Memory Management- Logical and Physical Address Space, Address Mapping, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging. Virtual memory- Demand paging and its performance, Page replacement algorithms- FIFO and LRU, Thrashing.

Module V: File and I/O System Management (8 Hours)
File management (Systems, Secondary Storage Structure)-File Concepts, Access methods, Directory Structure, Protection and consistency, Recovery.
I/O System Management- Overview of I/O Systems, I/O Interface, Secondary Storage Structure-Disk Structure and Scheduling methods, Disk management, Swap – Space management.

Suggested Readings
1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.
2. Tannenbaum," Modern Operating Systems", PHI
3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.
4. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd.
5. Mandik and Donovan, Operating Systems, Mcgraw Hill.

E Resources
1. NPTEL SWAYAM Course on- Introduction to Operating Systems, By Prof. Chester Rebeiro, IIT Madras
2. NPTEL SWAYAM Course on- Operating System Fundamentals, By Prof. Santanu Chattopadhyay, IIT Kharagpur
3. Operating System, Udemy

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H		H	
CO 3			H	H	
CO 4					H

CAOS205L: OPERATING SYSTEMS LAB
(2 CREDIT-30 Hours) (L-T-P) (0-0-2)

COURSE / LEARNING OUTCOMES
At the end of Introduction to Operating Systems Lab students will be able to:
CO 1: Experiment with *fork()* system call to create a new process.
CO 2: Infer the concepts related to shell programming and their significance.
(Understanding) CO 3: Experiment with various scheduling algorithms (FCFS, SJF
and Round Robin). (Applying)
CO 4: Examine the results obtained from page replacement algorithms-(FIFO, LRU), and understand the underlying
principles and working of space management concepts. (Analysing)

List of experiments-
1. Programs using fork system calls.
2. Shell programming.
3. Programs to simulate process scheduling- FCFS, SJF and Round Robin.
4. Programs to simulate page replacement algorithms-FIFO, LRU.
5. Programs to simulate free space management.

E-resource for learning:
Linux-Ubuntu, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H

CACA206T: COMPUTER ORGANIZATION AND ARCHITECTURE
(3 Credits – 45 hours) (L-T-P: 3-1-0)

Objective
This course aims to provide the student with the concepts and basic knowledge necessary to understand the organisation and architecture of computing systems.

COURSE / LEARNING OUTCOMES

7. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India

E Resources
1. Oracle course on Oracle Fusion Cloud Enterprise Resource Planning Training and Certification
2. Udemy course on SAP ERP Fundamentals

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			M
CO 2		H	M		
CO 3		M	H		M
CO 4			M	H	
CO 5				M	H

CAWD211T: BASICS OF WEB DESIGNING
(3 Credit – 45 Hours) (L-T-P: 3-0-0)

Objective
The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages and scripting language are also being discussed to make the student competent to design websites.

COURSE/LEARNING OUTCOMES
On successful completion of the course students will be able to:
CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet.
(Remembering) CO 2: Identify and differentiate the various services provided by the internet.
(Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static
website. (Applying) CO 4: Experiment with various scripting languages to design a dynamic
website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basics of Internet and XHTML (15 Hours)
Basics of Internet: History of the Internet and the World Wide Web; W3C; Levels of Internet Connectivity; Requirements for Internet Connectivity; Search Engines, Various Internet Services, Web Portal; Different types of browsers; URLs, Domain names, HTTP and URL
XHTML: Basic HTML Tags – html, head, title, body, paragraph, headings, horizontal, break, image, table, lists, links, and forms. Introduction to XHTML; HTML vs. XHTML, XHTML comments;

Module II: Cascading Style Sheets and JavaScript (18 Hours)
Cascading Style Sheets: Types of Style Sheets - Inline, Embedded, and External; CSS Text properties, font properties, and Background properties; CSS Borders and Outlines, CSS Box Model, Style class and Pseudo-class
JavaScript: Client-side scripting, Introduction to JavaScript, Simple JavaScript code, JavaScript variables, functions, conditions and loops

Module III: Website Design Considerations and Web Servers (12 Hours)
Website Design Considerations: Planning to design a website, use of sitemaps, Creating a compatible website for different color depths, resolutions, and browser considerations, validating a website

Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP, MAMP, XAMPP

Suggested Readings
1. Steven Holzner,"HTML Black Book", Dremtech Press
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real-World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

E Resources
1. Spoken Tutorial on HTML by Praveen S, IIT Bombay

2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
1	H		
2	H		
3	H	H	
4		H	
5	M	L	H

CAWR212L: BASICS OF WEB DESIGNING LAB
(1 Credit - 15 Hours) (L-T-P: 0-0-1)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES
At the end of the experiments, students will be able to
CO 1: Experiment with various mark-up languages and style sheets to design a static web
site (Applying) CO 2: Develop and create a dynamic website using scripting language.
(Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a
        website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)
Web Designing: Creating static websites involving various XHTML
elements. Using Style Sheets: Designing web pages that use CSS
for standard formatting

Module II: Dynamic Web Designing (5 Hours)
JavaScript: Designing websites that use JavaScript for creating interactive web pages

Suggested Readings
1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
1	H	
2		H
3	H	M

CAPT310T: BASICS OF PYTHON
(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective:

The objective of the course is to provide learners with a solid foundation in the fundamentals of the Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Learn the syntax, semantics and OOP concepts of Python Programming
Language. CO 2: Comprehend the flow control logic in Python
CO 3: Use Python functions to facilitate code reuse and manipulate strings.
CO 4: Illustrate the process of exception handling, structuring the data using lists, tuples and dictionaries.

Module I: Introduction to Python (8 hours)
What is Python? and history of Python, Unique features of Python, Install Python and Environment Setup, Python Identifiers, Keywords and Indentation, Comments and document interlude in Python, Command line arguments, Getting User Input, Python Data Types, variables

Module II: Control Statements (8 hours)
if-else, if-elif-else, while loop, for loop, break, continue, assert,
pass, return List, Ranges & Tuples in Python
Lists in Python, Understanding Iterators, Generators, Comprehensions and Lambda Expressions, Generators and Yield, Next and Ranges, Understanding and using Ranges, Ordered Sets with tuples
Python Dictionaries and Sets
Introduction to the section, Python Dictionaries, More on Dictionaries, Sets, Python Sets Examples

Module III: Input and Output in Python (8 hours)
Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
Python built in function, Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages

Module IV: OOP concept in Python (6 hours)
Overview of OOP, The self-variable, Constructor, Namespaces, Creating Classes and Objects, Inheritance, Types of Methods, Instance Methods, Static Methods, Class Methods, Accessing attributes, Built-In Class Attributes, Destroying Objects, Abstract classes and Interfaces, Abstract Methods and Abstract class, Interface in Python, Abstract classes and Interfaces

Suggested Readings
1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978- 0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN:
   978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978- 8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978- 9332555365.

E Resources
1. Coursera course on Introduction to Python Fundamentals
2. Udemy course on Extensive Python Fundamentals in 4 Weeks

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L	H	H	H
2		H	H	H
3	L	M	M	H
4	H		H	H

CAPT311L: BASICS OF PYTHON LAB

(2 Credits- 30 Hours) (L-T-P: 0-0-2)

Objective
The objective of the course is to provide learners with a solid foundation in the practical knowledge of Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES
At the end of the lab experiments, students will be able to learn
CO 1: Writing programs in python, Understanding the basic structure of Python
programming. CO 2: Understanding the built – in libraries
CO 3: Implementing the concepts of OOPs in Python

Lists of experiments:
1. if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
2. List, Ranges & Tuples in Python

3. Python Dictionaries and Sets
4. Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
5. Constructor, Namespaces, Creating Classes and Objects

Suggested Readings

1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978- 0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978- 8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978- 9332555365.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO2		L	H	H	M
CO 3	M	M	M	H	H

CABS312T: BUSINESS STATISTICS
(4 Credit – 60 Hours) (L-T-P: 2-0-0)

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Recall the key terminology, concepts tools and techniques used in business statistical analysis (Remembering)
CO 2: Understand the use of Graph Theory, Probability and Time-series analysis for management decisions. (Understanding) CO 3: Apply differential and inferential statistics to solve problems related to statistical analysis (Applying)
CO 4: Apply coorelation and regression analysis to solve problems related to statistical analysis (Applying)

Objective: *The objective of this course is to familiarize the students with basic concepts of Statistics in Business and an in-depth learning of the various statistical techniques. The aim of this course is to impart knowledge to students to improve their logical reasoning ability and interpretation of various business results. The course makes an effort to acquaint the students with the emerging issues in business, trade, and commerce regarding analyzing business facts.*

Module I: Introduction to Statistics, Frequency Distribution, and Graphs (12 Hours)
Introduction to Statistics: Statistics as a Subject of Study, Information and Data, Census data vs. Sample data, Methods of statistical data collection, Statistical Variables: Qualitative and Quantitative
Frequency Distribution and Graphs: Frequency, Stem and Leaf Display, Frequency Distributions, Data Grouping - Discrete and Continuous, Introduction to Graphs, Graph for Qualitative variables, Graph for Quantitative variables, Various types of graphs and diagrams: pictographs, bar diagram, scatter diagram, histogram, pie chart, frequency curve and frequency polygon

Module II: Descriptive and Inferential Statistics (18 Hours)

Descriptive Statistics: Measures of Central Tendency (Median, Mode, Arithmetic Mean, Geometric Mean, Harmonic Mean), Measures of Dispersion, Range, Co-efficient of Range, Quartiles, Inter-Quartile Range and Quartile Deviation, Standard Deviation, Skewness and Kurtosis; Co-efficient of Skewness: Karl Pearson's Coefficient
Inferential Statistics: Hypothesis Testing, Parametric vs. Non-Parametric tests, Parametric Tests (z-test, t-test, Chi-Square test, and F-test)

Module III: Correlation and Regression Analysis (15 Hours)
Correlation Analysis: Introduction to Correlation, Karl Pearson's product moment Co-efficient of Correlation, Positive, negative and zero correlation, Correlation through Scatter diagrams, Interpretation of Correlation Co-efficient, Simple and Multiple Correlation;
Regression Analysis: Regression and the criterion for the Line of Best Fit, Linear Regression, Logistic Regression, Polynomial Regression

Module IV: Probability and Probability Distributions (15 Hours)
Probability and Probability Distributions: Sample space and Events, Simple and Compound Events, Probability and

Probability distributions: Normal Distribution, Binomial and Poisson Distribution
Time-Series Analysis: Definition, Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA)

Suggested Readings
1. Sharma, Japuji K. *Business statistics*. Pearson Education India, 2012.
2. Bajpai, Naval. *Business statistics*. Pearson Education India, 2009.
3. Siegel, Andrew F. *Practical business statistics*. Academic Press, 2016.

E Resources
1. NPTEL course on Business Statistics
2. Study.com course on Business 212: Business Statistics

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
1	H	L		
2	H			H
3		H		
4			H	

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CACF106L	Computer Fundamentals	3
2	S E Course 2	CAHS213L	Hardware and Server Maintenance	3
3	S E Course 3	CAMG313L	Multimedia and Graphics	3

CACF106L: COMPUTER FUNDAMENTALS
(3 credits – 90 hours) (L-T-P:0-0-3)
After completing the course successfully, the students will be able to:
CO 1: Demonstrate working with Unix files, folders, applications and operations. (Understanding)
CO 2: Write SQL queries to handle single or multi-table queries and other complex queries. Creating)
CO 3: Apply explorative analysis techniques. (Applying)
CO 4: Evaluate the data visualization outcomes (Evaluating)

Module I: Introduction to the Unix Operating System
Unix kernel, file system, Directories, Navigating the file system, Filename wildcard characters, Manipulating files and directories, Overview of the vi editor, Basic functions, Searching and Replacing text, Searching for text with grep, Linking files, File Permissions and Access Control, Monitoring and killing process, wc, find, cut, sort command, Condition and loop Execution, User and Group management

Module II: SQL Operations Basic
Introduction to DBMS, Basic SQL Commands, Data Definition Language, Data Manipulation Language, SQL SELECT Statement, business analysis using SQL, math operation, joins, union, SQL built-in functions

Module III: Data Visualization using Spreadsheet
Introduction to data visualization, bar charts, clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, scatter plots, histograms, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, all relevant 2-D/3-D charts, sample analysis.

Suggested Reading
1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publications
2. Mansoor, I.T. Tools and Applications, Pragya Publications, Matura
3. Allen G. Taylor, SQL All-in-One for Dummies, Wiley

Mapping of CO to Syllabus

	Module I	Module II	Module III
CO1	H	L	L
CO2		H	
CO3	L	H	M
CO4			H

functions, Arrays, If statement, Switch statement, Looping statements, JavaScript Form Validation, Events in JavaScript.

Module IV: Web Servers and PHP (8 Hours)
1. Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP
2. PHP: Introduction to PHP; PHP Data Types; Control Structures; Functions; Strings; Arrays

Suggested Readings
1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

E Resources
1. Spoken Tutorial on HTML by Praveen S, IIT Bombay
2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah
4. Spoken Tutorial on PHP by Kavita Kharad

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2	H			
CO 3	H	H		
CO 4			H	H
CO 5		L	L	H

CAWT303L: WEB TECHNOLOGIES LAB
(2 CREDIT - 30 HOURS)

Objective
The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES
At the end of the experiments, students will be able to

CO 1: Experiment with various mark-up languages and style sheets to design a static web
site (Applying) CO 2: Develop and create a dynamic website using scripting languages.
(Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)
Web Designing: Creating static websites involving various XHTML
elements Cascading Style Sheets: Designing web pages that use CSS for
standard formatting

Module II: Dynamic Web Designing (5 Hours)
JavaScript: Designing websites that use JavaScript for creating interactive web pages
PHP: Designing websites that use PHP as server-side scripting language to connect and access the web server

Suggested Readings
1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II
CO 1	H	

CO 2		H	
CO 3	H	H	

CASE304T: SOFTWARE ENGINEERING
(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective
To provide the ability to analyse a scenario and produce a problem statement. The learners will be able to produce a conceptual solution which includes sample prototypes, domain models, and user stories. The learners will be able to describe the attributes and activities involved in software development process models and testing.

COURSE/LEARNING OUTCOMES
At the end of this course, students will be able to:
CO 1: Relate and examine the life cycle models of software. (Remembering)
CO 2: Interpret and differentiate various software life cycle models(Understanding)
CO 3: Experiment with different software architectures and identify the best feasible one (Applying)
CO 4: Analyse and design the software requirement specification and formulate an effort estimation plan (Analysing) CO 5: Develop and create various design diagrams and find solutions to problems. (Creating)

Module I (15 Hours)
Problems and solutions: Why software is developed. Problem and vision statements. Goals and objectives. Definitions and paradigms, A generic view of software engineering. Software development life cycle, Role of quality, metrics and measurement, The feasibility study, Software Requirement Analysis and Specifications, work breakdown structure (WBS), Problem Analysis, Creating software requirement specification document (SRS).

Module II (15 Hours)
Process Models: How software is built. The fundamental design concept for data, architectural and procedural designs, Conceptual solutions, Agile concept and User stories. Domain modeling with UML diagrams-Class diagram, Use cases etc, Object oriented design paradigm; Creation of technical design document, The relationship between design and implementation, Coding the procedural design, Good coding style and review of correctness and readability.

Module III (15 Hours)
Strategies of software testing. Types of testing, functional testing, validation and verifications, Test Case Design, Maintenance as part of software evaluation, techniques and procedures for maintenance, Introduction to configuration Management, The concept of CASE, green engineering.

Suggested Readings:
1. Sommerville, "Software Engineering", Addison Wesley.
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

E Resources
4. Udemy course on Complete Software Engineering Course : Build Better Software
5. NPTEL course on Software Engineering By Prof. Rajib Mall, IIT Kharagpur

Mapping of COs to Syllabus
Course Outcomes	Module I	Module II	Module III
CO 1	H	M	L
CO 2		H	L
CO 3	H	M	L
CO 4		H	H
CO 5			H

CASE305L: SOFTWARE ENGINEERING LAB
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Implement the software engineering process to develop any software project and formulate an effort estimation plan. (Understanding)
CO 2: Apply software design patterns. (Applying)
CO 3: Maintain the software project by using maintenance plan. (Creating)

Module I (5 Hours)
Identifying the requirements from problem

statements. Estimation of project metrics. Modelling
Data Flow Diagrams

Module II (3 Hours)
Development of User stories.
Identifying domain classes from the problem statements

Module III (7 Hours)
Modeling UML use case diagram & capturing use
case scenarios Class diagram, Activity diagram etc.
Designing test suite and testing.

Suggested Readings
1. Lab using IBM RSA tools
2. Virtual lab Weblink: http://vlabs.iitkgp.ernet.in/se/

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	H
CO 2	L	H	H
CO 3	H	L	H

CACC306T: CLOUD COMPUTING
(4 credits-60Hours) (L-T-P: 4-0-0)

Objective
This course is designed to enable students
·   *To get acquaint with the latest computational model, i.e. cloud computing*
·   *To understand the basic foundational elements of cloud computing*
·   *To study details of Data storage in cloud, big data file handling and parallel computing basics*
·   *To get familiarized with popular cloud platforms and applications*

COURSE / LEARNING OUTCOMES
On successful completion of the course students will be able to:
CO 1: Recall and identify the various cloud service models. (Remembering)
CO 2: Understand the basic concepts of Big Data and interpret using Hadoop.
(Understanding). CO 3: Identify and relate security issues with respect to cloud
environment. (Applying)
CO 4: Analyse the Quality of Service rendered by various cloud service providers. (Analysis)

Module I: Introduction and Cloud Service Models (15 Hours)
Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a- Service, Platform-as-a-Service, Software-as-a-Service, Building Cloud Network on amazon web service as VPC.

Module II: Cloud data handling (18 Hours)
Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The Map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map- Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map- reduce.

Module III: Security Issues (15 Hours)
Putting security on the spot with questions: Understanding Security Risks, Reducing Cloud Security Breaches, Vulnerability assessment tools, Cloud computing security architecture, Architectural considerations, general issues, Trusted cloud computing, Cloud computing security challenges, Virtualization security management, VM Security recommendations, Secure execution environments and communications in cloud.

Module IV: Quality of Service (QoS) in Cloud (12 Hours)
Issues in cloud computing, implementing real-time application over cloud platform, Issues in Inter cloud environments, Dependability, Dita migration, streaming in cloud, Quality of Service (QoS) monitoring in cloud computing environment, taking virtualization into cloud, develop an application on cloud platform and deploy.

Suggested Readings:
1. John W. Rittinghouse , "*Cloud Computing: Implementation, Management, and Security*", CRC Press
2. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "*Cloud Computing for Dummies*",Wiley India Edition
3. Gautam Shroff, "*Enterprise Cloud Computing*", Cambridge

4. Ronald Krutz and Russell Dean Vines, "*Cloud Security*", Wiley-India
5. Jeffrey Dean, Sanjay Ghemawat, "*MapReduce: Simplified Data Processing on Large Clusters*", OSDI'04: Sixth Symposium on
   Operating System Design and Implementation,San Francisco, CA, December, 2004.
6. Tim Malhar, S.Kumaraswammy, S.Latif,"*Cloud Security & Privacy*",SPD,O'REILLY
7. Antohy T Velte, et.al,"*Cloud Computing : A Practical Approach*", McGraw Hill,

E Resources
1. http://aws.amazon.com/
2. SWAYAM course on Cloud computing by Prof. Soumya Kanti Ghosh, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	L
CO 4			M	H

CAAD307T: ANDROID APPLICATION DEVELOPMENT FUNDAMENTALS
(4 credits-60Hours) (L-T-P: 4-0-0)

Objective
This course is designed to enable students to get a complete understanding of the development of android applications. On completion of this course, students will be able to design, develop, debug and deploy various real-time applications.

COURSE / LEARNING OUTCOMES
CO 1: Interpret the android architecture and configure the development environment (Understanding) CO 2: Design and build user defined app with different types of menus and views (Applying)
CO 3: Make use of AsyncTask for accomplishing different background task (Applying)
CO 4: Create SQlite database and use views to interact with the database and publishing of application.(Creating)

Module I: Get started (10 Hours)
Get started: Build your first app, Introduction to Android, Create Your First Android App, Layouts, Views and Resources, Text and Scrolling Views. Activities: Understanding Activities and Intents, the Activity Lifecycle and Managing State, Activities and Implicit Intents. Testing, debugging, and using support libraries: The Android Studio Debugger, Testing your App, The Android Support Library

Module II: User experience (13 Hours)
User interaction: User Input Controls, Menus, Screen Navigation, Recycler View, Delightful user experience: Drawables, Styles, and Themes, Material Design, Providing Resources for Adaptive Layouts Testing your UI: Testing the User Interface

Module III: Working in the background (15 Hours)
Background Tasks: Async Task and Async Task Loader, connect to the Internet, Broadcast Receivers, Services, Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, Transferring Data Efficiently

Module IV: All about data (22 Hours)
Preferences and Settings: Storing Data, Shared Preferences, App Settings b) Storing data using SQLite: SQLite Primer, SQLite Database, Sharing data with content providers: Share Data Through Content Providers d) Loading data using loaders: Loaders. Permissions, Performance and Security, Firebase and AdMob, Publish

Suggested Readings
1. Android Developer Fundamentals Course – E-book by the Google Developer Training team.
2. The practical workbook: Android Developer Fundamentals Course—Practical's E-book.
3. Slide decks & Videos of lectures for reference provided by Google.

E Resources
4. Udemy Course on Learn Android Application Development: A beginner course on Android Application development
5. Coursera Course on Introduction to Android Mobile Application Development

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		

CO 3		H	H	
CO 4			M	H

CANS308T: NETWORK SECURITY

(4 credits – 60 hours) (L-T-P:4-0-0)

Objective

The objective of the course is to learn the network security attacks, system vulnerabilities and strategies that can be deployed to increase the efficiency of the network service.

COURSE / LEARNING OUTCOMES

CO 1: Recall and identify the different security attacks, requirements, mechanisms and services in the practical field. (Remembering)

CO 2: Recognize and summarize the core principles of cryptography and cryptanalysis available today, including symmetric and asymmetric encryption, hashing, and digital signatures. (Understanding)

CO 3: Identify and relate themselves with the different vulnerabilities, a system in a network can have.

(Applying) CO 4: Inference and predict the issues of securing computer and information systems.

(Analyzing)

CO 5: Construct how malicious code functions, relate the vulnerabilities that make proliferation possible and rewrite methods and practices available for alleviation. (Creating)

Module 1 (18 hours)

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module 2 (18 hours)

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Module 3 (12 hours)

Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module 4 (12 hours)

Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems, Intrusion Detection Systems, Ransomware and different types of Ransomware, Methodology of execution of Ransomware.

Suggested Readings

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
4. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
5. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
6. Principles of Information Security, Whitman, Cengage Learning.
7. Cryptography and Network Security, S.Bose , Pearson

E Resources

1. SWAYAM: Introduction to Cyber Security (IGNOU)o   https://onlinecourses.swayam2.ac.in/nou24_cs13/preview
2. Cybrary - Free and paid courses on various aspects of network security. Cybrary Network Security
3. SANS Institute - Cybersecurity training and certification programs. SANS Institute
4. Kali Linux Documentation - Resources for using Kali Linux in network security. Kali Linux Documentation
5. OWASP - Resources and tools for improving web application security. OWASP
6. Coursera Network Security Courses - Various courses on network security fundamentals and advanced topics. Coursera Network Security
7. E-Book: Introduction to Cyber Security https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	M	
CO 3	L	H	M	L
CO 4	L	M	H	M
CO 5		M	H	L

CAPW309P: MINOR PROJECT
(4 credits – 60 hours) (L-T-P: 0-0-4)

Objective
This course aims to provide the student with various practical knowledge on different problem specific system deployment techniques and analysis.

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Recall different processes involved in software development life cycle
(Remembering). CO 2: Understanding the problem statement and related
literature study (Understanding).
CO 3: Analyse end user requirements for identifying system functionality metrics and decide whether developed
system can meet end user requirements. (Analysing)
CO 4: Choose an engineering approach to solving problems, starting from the acquired   knowledge to visual
interpretation. (Evaluating)
CO 5: Propose the use of certain technologies by implementing them in different programming languages to solve the
problem statement (Creating).

Module 1
Feasibility study of the problem statement and solution, evaluation of existing system, finding the limitation of existing system

Module 2
Literature study, identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification software development metrics

Module 3
Evaluate Design diagrams for solving the problem statement. Identify deployment strategy.

Module 4
Develop algorithms and implement those using programming languages. Resolve and implement the problem statement through proposed software model and system architecture.

Module 5
Prepare a report to highlight the problem statement, design diagram, technologies deployed, and references used to resolve end user's requirement.

Suggested Readings:
1.   Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
2.   Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	L	
CO 2	H	H			
CO 3	L	L	H	H	M
CO 4		L	H	H	L
CO 5			M	H	H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CALE104T	Cyber Law and Ethics	4
2	Minor Course 2	CAET105T	E-Commerce Technology	4
3	Minor Course 3	CAER210T	Enterprise Resource Planning	4
4	Minor Course 4	CAWD211T	Basics of Web Designing	4

5	Minor Course 5	CAPT310T	Basics of Python	2
		CAPT311L	Basics of Python Lab	4
6	Minor Course 6	CABS312T	Business Statistics	4

CALE104T: CYBER LAW AND ETHICS
(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective

The course aims to learn about the different cyber threats, law and ethics that are associated with cyberspace.

COURSE/LEARNING OUTCOMES:
At the end of the course, students will be able to:
CO 1: Identify knowledge related to the constitution and its legal issues in cyberspace.
(Remembering) CO 2: Explain the different cybercrimes, and the related cyber laws.
(Understanding)
CO 3: Demonstrate the different perspectives of professional ethics and responsibilities of engineers. (Understand)
CO 4: Illustrate the concepts behind Cyber Torts, Intellectual Property Rights and describe the concepts in connection to dispute resolution in cyberspace. (Analyzing)

Module I (14 Hours)
Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection, Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud Cyber terrorism, Cyber Defamation.

Module II (18 Hours)
Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies, Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering

Module III (14 Hours)
Cyber Torts Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Intellectual Property Issues in Cyber Space Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Module IV (14 Hours)
Dispute Resolution in Cyberspace, Concept of Jurisdiction, Indian Context of Jurisdiction, and IT Act, 2000. International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions.

Suggested Readings
1. Engineering Ethics M. Govindarajan, S. Natarajan, V. S. Senthilkumar Prentice –Hall, 2004
2. Constitution of India, Professional Ethics and Human Rights Shubham Singles, Charles E. Haries, and et al Cengage Learning India 2018
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
5. Jonthan Rosenoer, Cyber Law, Springer, New York.
6. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.

E Resources
1. SWAYAM Course on Cyber Laws by Vishal Goyal   Punjabi University - Patiala

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M	M	M
CO 2	L	H	H	M
CO 3	L	H	M	M
CO 4		M	H	M

CAET105T: E-COMMERCE TECHNOLOGY
(4 CREDITS- 60 HOURS) (L-T-P: 4-0-0)

Objectives

To enable the student to become familiar with the mechanism for conducting business transactions through electronic means, buildup knowledge on electronic business, online marketing and make the students to devise marketing strategies for concerns engaged in ecommerce and understand the current status of e-business.

COURSE/LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO 1: Interpret the basic concepts and technologies used in the field of E-Commerce.
(Remembering) CO 2: Explain the different regulatory provisions relating to E-Commerce.
(Understanding)
CO 3: Develop processes of developing and implementing information systems.
(Applying) CO 4: Define the ethical, social, and security issues of information
systems. (Analysing)
CO 5: Evaluate the various online business transactions (Evaluating)

Module I: Introduction (12 Hours)

E – Commerce: Meaning, definition, features, functions of E-Commerce, Scope, Benefits and limitations of E-Commerce – The Internet and India – E-commerce opportunities and challenges for Industries Technology used in E-commerce: The dynamics of world wide web and internet (meaning, evolution and features); Designing, building and launching e-commerce website (A systematic approach involving decisions regarding selection of hardware, software, outsourcing vs. in-house development of a website)

Module II: Electronic Data Interchange (12 Hours)

Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI, EDI Agreements, EDI Security, Business Model, E- business Models Based on the Relationship of Transaction Parties: Business-to-Consumer (B2C), Business to-Business (B2B), Consumer-to-Consumer (C2C), Consumer-to-Business (C2B), E-business Models Based on the Relationship of Transaction Types: Brokerage Model, Aggregator Model, Implementation, Legal Framework for E-Commerce: E-Commerce Legal Framework, Rights and Obligations in the World of E-commerce , Copyrights , Defamation, Privacy, Contracts, Taxation, Signing a contract Electronically ,Domain name and Registration.

Module III: E-payment System (12 Hours)

E-payment Systems: Digital payment Requirements, Digital Token-based E-payment systems, Benefits to Buyers , Benefits to Sellers, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E- Cash, Risk and e-Payment Systems, Designing e-Payment Systems, E-Retailing, E services.
E-Finance: Areas of Financing, E-Banking, Traditional Banking Vs. E-Banking, Operations in E-Banking, E-Trading, Stock Market trading, Importance and advantages of E-Trading.

Module IV: Security and Encryption: (12 Hours)

E-commerce security environment: dimension, definition and scope of e- security, security threats in the E-commerce environment, technology solutions, business procedures, and public laws , Threats in Computer Systems: Virus, Cyber Crime, Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

Module V: IT Act 2000 and Cyber Crimes (12 Hours)

IT Act 2000: Definitions, Digital signature, Electronic governance, Attribution, acknowledgement and dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers, Penalties and adjudication, Appellate Tribunal, Offences and Cyber-crimes

Suggested Readings

1. Joseph P. T., E - Commerce – An Indian Perspective
2. Kenneth C. Laudon and Carlo GuercioTraver, E-Commerce,Pearson Education.
3. David Whiteley, E-commerce:Strategy,TechnologyandApplications,McGrawHill Education
4. Bharat Bhaskar, Electronic Commerce: Framework, Technology and Application, 4thEd., McGraw Hill Education
5. Joseph P T, E-Commerce: An Indian Perspective, PHILearning
6. Bajaj K K and Debjani Nag, E-commerce, McGraw HillEducation
7. Chhabra T N, E-Commerce, Dhanpat Rai Co.
8. Madan Sushila, E-Commerce, Taxmann

E Resources
1. Udemy Course on Mastering E-commerce: The Ultimate Course
2. Swayam course on E-Business By Prof. Mamata Jenamani, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			M
CO2	M	H			

		M	H		M
CO3		M	H		M
CO4			M	H	
CO5			H	M	M

CAER210T: ENTERPRISE RESOURCE PLANNING
(4 CREDITS – 60 HOURS) (L-T-P: 4-0-0)

Objective
To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:

CO 1: Recall the conceptual elements of ERP. (Remembering)

CO 2: Demonstrate the Influence of ERP in Large Organizations. (Understanding)

CO 3: Identify the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (Applying)

CO 4: Analyse the practical side of ERP implementation with different vendors. (Analysing)

CO 5: Discuss and evaluate the best practices of ERP with various case studies and real time examples. (Creating, Evaluating)

Module I: ERP Basics (15 hours)
Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modelling, integrated data model ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (10 hours)
Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (10 hours)
SAP AG: R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet BAAN: Baan ERP modules, Baan ERP Tools Oracle: Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain. PeopleSoft: Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (10 hours)
Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support,

Problems in ERP implementation, cost of ERP.

Module V Best Practices in ERP (15hours)
Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP. Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Suggested Readings
1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge
   University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning: Concepts and Practice, 2nd edition, Prentice Hall India

7. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India

E Resources
1. Oracle course on Oracle Fusion Cloud Enterprise Resource Planning Training and Certification
2. Udemy course on SAP ERP Fundamentals

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			M
CO 2		H	M		
CO 3		M	H		M
CO 4			M	H	
CO 5				M	H

CAWD211T: BASICS OF WEB DESIGNING
(3 Credit – 45 Hours) (L-T-P: 3-0-0)

Objective
The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages and scripting language are also being discussed to make the student competent to design websites.

COURSE/LEARNING OUTCOMES
On successful completion of the course students will be able to:
CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet.
(Remembering) CO 2: Identify and differentiate the various services provided by the internet.
(Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static
website. (Applying) CO 4: Experiment with various scripting languages to design a dynamic
website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basics of Internet and XHTML (15 Hours)
Basics of Internet: History of the Internet and the World Wide Web; W3C; Levels of Internet Connectivity; Requirements for Internet Connectivity; Search Engines, Various Internet Services, Web Portal; Different types of browsers; URLs, Domain names, HTTP and URL
XHTML: Basic HTML Tags – html, head, title, body, paragraph, headings, horizontal, break, image, table, lists, links, and forms. Introduction to XHTML; HTML vs. XHTML, XHTML comments;

Module II: Cascading Style Sheets and JavaScript (18 Hours)
Cascading Style Sheets: Types of Style Sheets - Inline, Embedded, and External; CSS Text properties, font properties, and Background properties; CSS Borders and Outlines, CSS Box Model, Style class and Pseudo-class
JavaScript: Client-side scripting, Introduction to JavaScript, Simple JavaScript code, JavaScript variables, functions, conditions and loops

Module III: Website Design Considerations and Web Servers (12 Hours)
Website Design Considerations: Planning to design a website, use of sitemaps, Creating a compatible website for different color depths, resolutions, and browser considerations, validating a website

Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP, MAMP, XAMPP

Suggested Readings
1. Steven Holzner,"HTML Black Book", Dremtech Press
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real-World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

E Resources
1. Spoken Tutorial on HTML by Praveen S, IIT Bombay

2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
1	H		
2	H		
3	H	H	
4		H	
5	M	L	H

CAWR212L: BASICS OF WEB DESIGNING LAB
(1 Credit - 15 Hours) (L-T-P: 0-0-1)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES

At the end of the experiments, students will be able to
CO 1: Experiment with various mark-up languages and style sheets to design a static web
site (Applying) CO 2: Develop and create a dynamic website using scripting language.
(Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a
     website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)

Web Designing: Creating static websites involving various XHTML
elements. Using Style Sheets: Designing web pages that use CSS
for standard formatting

Module II: Dynamic Web Designing (5 Hours)

JavaScript: Designing websites that use JavaScript for creating interactive web pages

Suggested Readings
1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
1	H	
2		H
3	H	M

CAPT310T: BASICS OF PYTHON
(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective:

The objective of the course is to provide learners with a solid foundation in the fundamentals of the Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO 1: Learn the syntax, semantics and OOP concepts of Python Programming
Language. CO 2: Comprehend the flow control logic in Python
CO 3: Use Python functions to facilitate code reuse and manipulate strings.
CO 4: Illustrate the process of exception handling, structuring the data using lists, tuples and dictionaries.

Module I: Introduction to Python (8 hours)
What is Python? and history of Python, Unique features of Python, Install Python and Environment Setup, Python Identifiers, Keywords and Indentation, Comments and document interlude in Python, Command line arguments, Getting User Input, Python Data Types, variables

Module II: Control Statements (8 hours)
if-else, if-elif-else, while loop, for loop, break, continue, assert,
pass, return List, Ranges & Tuples in Python
Lists in Python, Understanding Iterators, Generators, Comprehensions and Lambda Expressions, Generators and Yield, Next and Ranges, Understanding and using Ranges, Ordered Sets with tuples
Python Dictionaries and Sets
Introduction to the section, Python Dictionaries, More on Dictionaries, Sets, Python Sets Examples

Module III: Input and Output in Python (8 hours)
Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
Python built in function, Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages

Module IV: OOP concept in Python (6 hours)
Overview of OOP, The self-variable, Constructor, Namespaces, Creating Classes and Objects, Inheritance, Types of Methods, Instance Methods, Static Methods, Class Methods, Accessing attributes, Built-In Class Attributes, Destroying Objects, Abstract classes and Interfaces, Abstract Methods and Abstract class, Interface in Python, Abstract classes and Interfaces

Suggested Readings
1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978- 0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN:
    978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978- 8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978- 9332555365.

E Resources
1. Coursera course on Introduction to Python Fundamentals
2. Udemy course on Extensive Python Fundamentals in 4 Weeks

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L	H	H	H
2		H	H	H
3	L	M	M	H
4	H		H	H

CAPT311L: BASICS OF PYTHON LAB

(2 Credits- 30 Hours) (L-T-P: 0-0-2)

Objective
The objective of the course is to provide learners with a solid foundation in the practical knowledge of Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES
At the end of the lab experiments, students will be able to learn
CO 1: Writing programs in python, Understanding the basic structure of Python
programming. CO 2: Understanding the built – in libraries
CO 3: Implementing the concepts of OOPs in Python

Lists of experiments:
1. if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
2. List, Ranges & Tuples in Python

3. Python Dictionaries and Sets
4. Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
5. Constructor, Namespaces, Creating Classes and Objects

Suggested Readings
1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978- 0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978- 8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978- 9332555365.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO2		L	H	H	M
CO 3	M	M	M	H	H

CABS312T: BUSINESS STATISTICS
(4 Credit – 60 Hours) (L-T-P: 2-0-0)

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Recall the key terminology, concepts tools and techniques used in business statistical analysis (Remembering)
CO 2: Understand the use of Graph Theory, Probability and Time-series analysis for management decisions. (Understanding) CO 3: Apply differential and inferential statistics to solve problems related to statistical analysis (Applying)
CO 4: Apply coorelation and regression analysis to solve problems related to statistical analysis (Applying)

Objective: *The objective of this course is to familiarize the students with basic concepts of Statistics in Business and an in-depth learning of the various statistical techniques. The aim of this course is to impart knowledge to students to improve their logical reasoning ability and interpretation of various business results. The course makes an effort to acquaint the students with the emerging issues in business, trade, and commerce regarding analyzing business facts.*

Module I: Introduction to Statistics, Frequency Distribution, and Graphs (12 Hours)
Introduction to Statistics: Statistics as a Subject of Study, Information and Data, Census data vs. Sample data, Methods of statistical data collection, Statistical Variables: Qualitative and Quantitative
Frequency Distribution and Graphs: Frequency, Stem and Leaf Display, Frequency Distributions, Data Grouping - Discrete and Continuous, Introduction to Graphs, Graph for Qualitative variables, Graph for Quantitative variables, Various types of graphs and diagrams: pictographs, bar diagram, scatter diagram, histogram, pie chart, frequency curve and frequency polygon

Module II: Descriptive and Inferential Statistics (18 Hours)

Descriptive Statistics: Measures of Central Tendency (Median, Mode, Arithmetic Mean, Geometric Mean, Harmonic Mean), Measures of Dispersion, Range, Co-efficient of Range, Quartiles, Inter-Quartile Range and Quartile Deviation, Standard Deviation, Skewness and Kurtosis; Co-efficient of Skewness: Karl Pearson's Coefficient
Inferential Statistics: Hypothesis Testing, Parametric vs. Non-Parametric tests, Parametric Tests (z-test, t-test, Chi-Square test, and F-test)

Module III: Correlation and Regression Analysis (15 Hours)
Correlation Analysis: Introduction to Correlation, Karl Pearson's product moment Co-efficient of Correlation, Positive, negative and zero correlation, Correlation through Scatter diagrams, Interpretation of Correlation Co-efficient, Simple and Multiple Correlation;
Regression Analysis: Regression and the criterion for the Line of Best Fit, Linear Regression, Logistic Regression, Polynomial Regression

Module IV: Probability and Probability Distributions (15 Hours)
Probability and Probability Distributions: Sample space and Events, Simple and Compound Events, Probability and

Probability distributions: Normal Distribution, Binomial and Poisson Distribution
Time-Series Analysis: Definition, Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA)

Suggested Readings
1. Sharma, Japuji K. *Business statistics*. Pearson Education India, 2012.
2. Bajpai, Naval. *Business statistics*. Pearson Education India, 2009.
3. Siegel, Andrew F. *Practical business statistics*. Academic Press, 2016.

E Resources
1. NPTEL course on Business Statistics
2. Study.com course on Business 212: Business Statistics

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
1	H	L		
2	H			H
3		H		
4			H	

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CACF106L	Computer Fundamentals	3
2	S E Course 2	CAHS213L	Hardware and Server Maintenance	3
3	S E Course 3	CAMG313L	Multimedia and Graphics	3

CACF106L: COMPUTER FUNDAMENTALS
(3 credits – 90 hours) (L-T-P:0-0-3)
    After completing the course successfully, the students will be able to:
    CO 1: Demonstrate working with Unix files, folders, applications and operations. (Understanding)
    CO 2: Write SQL queries to handle single or multi-table queries and other complex queries. Creating)
    CO 3: Apply explorative analysis techniques. (Applying)
    CO 4: Evaluate the data visualization outcomes (Evaluating)

Module I: Introduction to the Unix Operating System
    Unix kernel, file system, Directories, Navigating the file system, Filename wildcard characters, Manipulating files and directories, Overview of the vi editor, Basic functions, Searching and Replacing text, Searching for text with grep, Linking files, File Permissions and Access Control, Monitoring and killing process, wc, find, cut, sort command, Condition and loop Execution, User and Group management

Module II: SQL Operations Basic
    Introduction to DBMS, Basic SQL Commands, Data Definition Language, Data Manipulation Language, SQL SELECT Statement, business analysis using SQL, math operation, joins, union, SQL built-in functions

Module III: Data Visualization using Spreadsheet
    Introduction to data visualization, bar charts, clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, scatter plots, histograms, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, all relevant 2-D/3-D charts, sample analysis.

Suggested Reading
1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publications
2. Mansoor, I.T. Tools and Applications, Pragya Publications, Matura
3. Allen G. Taylor, SQL All-in-One for Dummies, Wiley

Mapping of CO to Syllabus

	Module I	Module II	Module III
CO1	H	L	L
CO2		H	
CO3	L	H	M
CO4			H

CAHS213L: HARDWARE AND SERVER MAINTENANCE
(3 credits – 45 hours) (L-T-P: 0-1-2)

COURSE/LEARNING OUTCOMES:
CO 1: To understand the different components of computer hardware and their functions.
CO 2: To be able to identify and explain the various types of servers and their uses and to appreciate the importance of
hardware and server maintenance in ensuring the smooth operation of computer systems.

CO 3: To learn basic hardware components and be able to install and configure operating systems on servers and
monitor the performance of servers and tune them for optimal performance.
CO 4: To understand data backup and disaster recovery procedures and implement them effectively and learn about
server virtualization, cloud computing, and high availability.

Module I: Introduction to Hardware and Server Maintenance: (5 hours)
Overview of computer hardware components, Types of servers and their uses, Importance of hardware and server
maintenance

Module II: Basic Computer Hardware Components: (10 hours)
Processor and memory, Motherboard and BIOS, Power supply and cooling, Hard drives and solid-state drives,
Input/Output (I/O) devices

Module III: Servers: (15 hours)
Web servers, Database servers, File servers, Mail servers, Virtual servers.
Operating system installation and configuration, Network configuration, Security updates and patches,
Performance monitoring and tuning, Data backup and disaster recovery

Module IV: Advanced Topics in Hardware and Server Maintenance (20 hours)
Server virtualization, Cloud computing, High availability and redundancy, Storage area networks (SAN),
Network-attached storage (NAS) Documentation and asset management, Preventive maintenance, Disaster
planning and recovery, Compliance and regulatory requirements

Module V: Practical, Case Studies and Hands-On Labs (10 hours)
·   Hands-on experience with hardware and server maintenance tasks
·   Case studies of real-world hardware and server maintenance scenarios
·   Independent research on a topic related to hardware and server maintenance
·   Presentation of findings and recommendations

Suggested Readings
1.   "Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L.
       Hennessy
2.   "Operating System Concepts" by Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne
3.   "Essential System Administration: Tools and Techniques for Linux and Unix Administration" by AEleen Frisch
4.   "Windows Server 2019 Inside Out" by Orin Thomas and J.C. Mackin
5.   "Linux Server Hacks: 100 Industrial-Strength Tips and Tools" by Nicholas D. Wells
6.   "Data Center Fundamentals" by José Manuel Moreno Pérez and Jorge Bañuelos García
7.   "Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications,
       Management, and File Systems" by Marc Farley
8.   "Virtualization: A Beginner's Guide" by Sander van Vugt
9.   "The Cloud Adoption Playbook: Proven Strategies for Transforming Your Organization with the Cloud" by Ryan
       O'Hara
10.   "Disaster Recovery Planning: Preparing for the Unthinkable" by Jon William Toigo.
E Resources
1.   Udemy: Computer Hardware, Operating System and Networking
2.   CompTIA - Training and certifications for hardware and server maintenance.
3.   TechTarget - Articles and guides on server maintenance and hardware troubleshooting.
4.   Cisco Networking Academy - Courses on server management and IT infrastructure.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H			
CO 2	M	M	M	M	
CO 3			M		M
CO 4					H

CAMG313L: MULTIMEDIA AND GRAPHICS
(3 Credits – 45 Hours) (L-T-P:0-0-3)

Objective

This course will introduce the students to relevant modules of multimedia and graphics using technical education tools. The course is designed to build up opportunities to understand graphic design, illustration, image manipulation, video editing, and

visual effects and experiment with the creativity and conceptualizing ability designing trends as solutions for representation of different aspects of social interaction.

COURSE/LEARNING OUTCOMES

CO 1: List the feature of multimedia tools for representation of design aspects (Remembering) CO 2: Explain the technique for multimedia design for content development. (Understanding) CO 3: Experiment with different editing process to solve problem statement. (Applying)
CO 4: Design prototype to represent any real-life scenario using multimedia techniques. (Creating)

Module I (15 hours):

Text, Font, Faces, animating Text, hyper text, sound – MIDI, audio editing, digitization of sound, audio filtering

Module II (15 hours):

Modelling , Lighting & Texturing, Character Rigging, Movie Merchandising, Video Editing & Compositing,

Module III (15 hours):

Portfolio Developments, Matte Painting, GNU Image Manipulation Program (GIMP)

Suggested Reading:
1. Fazreil Amreen, Instant GIMP Starter, PACKT Publishing
2. Jan Smith,Roman JoosGIMP for Absolute Beginners, Apress
E Resources
1. Web Link https://www.gimp.org/tutorials/
2. Coursera course on Interactive Computer Graphics
3. NPTEL course on Computer Graphics By Prof. Samit Bhattacharya, IIT Guwahati
4. NPTEL course on Introduction to Multimedia Systems and Processing, Prof. Somnath Sengupta, IIT Kharagpur

Mapping of Cos to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	L	
CO 2	H	M	
CO 3	H	H	H
CO 4	H	H	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CAIN107I	Internship	4
4	Internship	CAIN213I	Internship	4
5	Internship	CAIN314I	Internship	2

CAIN107I/ CAIN108I: INTERNSHIP
(4 Credits: 120 hours)

CAIN314I: INTERNSHIP
(2 Credits-60 Hours)

Objectives

The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in classroom courses to real-life industry work situations. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills.

COURSE/ LEARNING OUTCOMES

At the end of the internship, students will be able to:
CO 1: Relate theory and practical with real life examples. (Remembering)
CO 2: Explain the technical processes involved in the industry.

(Understanding) CO 3: Identify the importance of learning the computer technology. (Applying)
CO 4: Analyse application of computer technology into the practical field.
(Analysing) CO 5: Discuss the actual technological advancements in the industry. (Creating)

GUIDELINES:
The students should follow the following instruction and guidelines during the course of the internship:

The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.

- The students have to undergo the internship during the Summer/Winter Break.
- The students can undergo an internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to computer technology.
- After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
- There would be a Seminar Presentation (PPT) and Viva-Voce Examination based on which the students would be evaluated for the internship. The Internship report would also be a part of the evaluation.

STRUCTURE OF INTERNSHIP
The Internship Report must comprise the following:
a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as an intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

The Contents of the Report must include:
a. Introduction.
b. Objectives of the Internship.
c. About the Organisation (Sector, Activities, Operations).
d. Description of the work.
e. Learning Outcomes.

The Assessment for the internship must have the following components:
- Internship Report: 20 Marks
- Internship Diary: 20 Marks
- Seminar Presentation: 30 Marks
- Viva-Voce Examination: 30 Mark