# UNIVERSITY SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY DEPARTMENT OF INFORMATION TECHNOLOGY

# PROGRAMME STRUCTURE
# BACHELOR OF COMPUTER APPLICATIONS (BCA)
# 3 YEAR PROGRAMME

**GAUTAM BUDDHA UNIVERSITY**

**Gautam Budh Nagar, Greater Noida,**

**Uttar Pradesh 201308**

COURSE STRUCTURE

SEMESTER I

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| **1** | **BCA109** | **Computer Fundamentals and Programming in C** | 3 | 0 | 0 | 3 | CC1 / FC |
| **2** | **BCA111** | **Basics of Artificial Intelligence** | 3 | 0 | 0 | 3 | CC2 / FC |
| **3** | **BCA113** | **Introduction to Web Technology** | 3 | 0 | 0 | 3 | CC3 / SEC |
| 4 | BCA107 | Logical Organization of Computer | 3 | 0 | 0 | 3 | CC4 |
| 5 | MA151 | Mathematical Foundation of Computer Science-I | 3 | 1 | 0 | 4 | GE1 |
| 6 | EN101 | English Proficiency | 2 | 0 | 0 | 2 | OE1 / AECC |
| **7** | **BCA185** | **C Programming Lab** | 0 | 0 | 3 | 2 | CC-L1 / SEC |
| 8 | BCA187 | Web Technology Lab | 0 | 0 | 3 | 2 | CC-L2 |
| 9 | GP | General Proficiency | Non Credit | | | | |
| **Total Hours and Credits** | | | **17** | **3** | **6** | **22** | |

SEMESTER II

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| **1** | **BCA110** | **Fundamental of Operating System** | 3 | 0 | 0 | 3 | CC5 / SEC |
| **2** | **BCA112** | **Fundamentals of Data Science** | 3 | 0 | 0 | 3 | CC6 |
| 3 | BCA106 | System Analysis and Design | 3 | 0 | 0 | 3 | CC7 / FC |
| 4 | BCA108 | Digital Logic | 3 | 0 | 0 | 3 | CC8 |
| 5 | MA152 | Mathematical Foundation of Computer Science-II | 3 | 1 | 0 | 4 | GE2 |
| 6 | ES101 | Environmental Studies | 4 | 0 | 0 | 4 | OE2 / AECC |
| **7** | **BCA186** | **Operating System Lab** | 0 | 0 | 3 | 2 | CC-L3 /SEC |
| 8 | BCA188 | MS Excel Lab | 0 | 0 | 3 | 2 | CC-L4 |
| 9 | GP | General Proficiency | Non Credit | | | | |
| **Total Hours and Credits** | | | **19** | **1** | **6** | **24** | |

SEMESTER III

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| 1 | BCA201 | Python Programming | 3 | 0 | 0 | 3 | CC9 / SEC |
| 2 | BCA203 | Software Engineering Fundamentals | 3 | 0 | 0 | 3 | CC10 |
| 3 | BCA205 | Introduction to Data Base Management System | 3 | 0 | 0 | 3 | CC11 / FC |
| 4 | BCA207 | Fundamental of Data Structure | 3 | 0 | 0 | 3 | CC12 / SEC |
| 5 | BCA209 | Discrete Structure | 3 | 0 | 0 | 3 | CC13 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | BCA211 | Basics of Digital Marketing | 3 | 0 | 0 | 3 | CC14 |
| 7 | BCA281 | Python Programming Lab | 0 | 0 | 3 | 2 | CC-L5 / SEC |
| 8 | BCA283 | Database Management System Lab | 0 | 0 | 3 | 2 | CC-L6 |
| 9 | GP | General Proficiency | Non Credit | | | | |
| **Total Hours and Credits** | | | **18** | **0** | **6** | **22** | |

SEMESTER IV

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| 1 | BCA202 | Fundamentals of Java Programming | 3 | 0 | 0 | 3 | CC15 / SEC |
| 2 | BCA204 | Fundamental of Machine Learning | 3 | 0 | 0 | 3 | CC16 |
| 3 | BCA206 | Introduction to Information Security | 3 | 0 | 0 | 3 | CC17 |
| 4 | BCA208 | Basics of Theory of Computation | 3 | 0 | 0 | 3 | CC18 |
| 5 | BCA210 | Data Analytics Fundamentals | 3 | 0 | 0 | 3 | CC19 / SEC |
| 6 | BCA212 | Introduction of Soft Computing | 2 | 0 | 0 | 2 | CC20 |
| 7 | BCA282 | Java Programming Lab | 0 | 0 | 3 | 2 | CC-L7 / SEC |
| 8 | BCA292 | Minor Project | 0 | 0 | 10 | 5 | MP1 / E |
| 9 | GP | General Proficiency | Non Credit | | | | |
| **Total Hours and Credits** | | | **17** | **0** | **13** | **24** | |

SEMESTER V

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| 1 | BCA301 | PHP | 3 | 0 | 0 | 3 | C21 /SEC |
| 2 | BCA303 | Introduction to Compiler Design | 3 | 0 | 0 | 3 | CC22 |
| 3 | BCA305 | Basics of Computer Graphics | 3 | 0 | 0 | 3 | CC23 |
| 4 | BCA307 | Computer Networks Fundamentals | 3 | 0 | 0 | 3 | CC24 |
| 5 | BCA315 | Elective -1(Fundamentals of Cyber Security ) | 3 | 0 | 0 | 3 | E1 / DSE |
| 6 | BCA319 | Elective -2 (Introduction to Multimedia System) | 3 | 0 | 0 | 3 | E2 / DSE |
| 7 | BCA381 | PHP Lab | 0 | 0 | 3 | 2 | CC-L8 /SEC |
| 8 | BCA383 | Compiler Design Lab | 0 | 0 | 3 | 2 | CC-L9 |
| 9 | GP | General Proficiency | Non Credit | | | | |
| **Total Hours and Credits** | | | **18** | **0** | **6** | **22** | |

SEMESTER VI

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| 1 | BCA302 | .NET Technology | 3 | 0 | 0 | 3 | CC25 |
| 2 | BCA304 | Basics of Internet of Things | 3 | 0 | 0 | 3 | CC26 |
| 3 | | Elective-3 | 3 | 0 | 0 | 3 | E3 / DSE |
| 4 | | Elective-4 | 3 | 0 | 0 | 3 | E4 / DSE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | BCA382 | .NET Technology Lab | 0 | 0 | 3 | 2 | CC-L10 / SEC |
| 6 | BCA384 | Internet of Things Lab | 0 | 0 | 3 | 2 | CC-L11 / SEC |
| 7 | BCA392 | Major Project | 0 | 0 | 16 | 8 | MP2 / E |
| 8 | GP | | Non Credit | | | | |
| **Total Hours and Credits** | | | **12** | **0** | **22** | **24** | |

## ELECTIVES

| S.No. | Course Code | Course Name | L | T | P | Credits | Types |
|---|---|---|---|---|---|---|---|
| 1 | BCA309 | Fundamentals of Cloud Computing | 3 | 0 | 0 | 3 | E1 |
| 2 | BCA311 | Introduction to Fuzzy Logic | 3 | 0 | 0 | 3 | E1 |
| 3 | BCA313 | Basics of Natural Language Processing | 3 | 0 | 0 | 3 | E1 |
| 4 | BCA315 | Fundamentals of Cyber Security | 3 | 0 | 0 | 3 | E1 |
| 5 | BCA317 | Basics of Expert Systems | 3 | 0 | 0 | 3 | E2 |
| 6 | BCA319 | Introduction to Multimedia System | 3 | 0 | 0 | 3 | E2 |
| 7 | BCA321 | Information Security Fundamentals | 3 | 0 | 0 | 3 | E2 |
| 8 | BCA323 | Fundamental of Evolutionary Computing | 3 | 0 | 0 | 3 | E2 |
| 9 | BCA306 | Computer Network Security | 3 | 0 | 0 | 3 | E3 |
| 10 | BCA308 | Concepts of Mobile Computing | 3 | 0 | 0 | 3 | E3 |
| 11 | BCA310 | Basics of Blockchain | 3 | 0 | 0 | 3 | E3 |
| 12 | BCA312 | Introduction to Wireless Technology | 3 | 0 | 0 | 3 | E3 |
| 13 | BCA314 | Fundamentals of Optimization Techniques | 3 | 0 | 0 | 3 | E4 |
| 14 | BCA316 | Introduction to Computer Vision | 3 | 0 | 0 | 3 | E4 |
| 15 | BCA318 | Basics of Data Science | 3 | 0 | 0 | 3 | E4 |
| 16 | BCA320 | Fundamental of Digital Image Processing | 3 | 0 | 0 | 3 | E4 |
| **OPEN AND GENERIC ELECTIVES FROM OTHER SCHOOLS** | | | | | | | |
| 17 | EN101 | English Proficiency | 2 | 0 | 0 | 2 | OE1 |
| 18 | ES101 | Environmental Studies | 4 | 0 | 0 | 4 | OE2 |
| 19 | MA151 | Mathematical Foundation of Computer Science-I | 3 | 1 | 0 | 4 | GE1 |
| 20 | MA152 | Mathematical Foundation of Computer Science-II | 3 | 1 | 0 | 4 | GE2 |

**SEMESTER I**

| COMPUTER FUNDAMENTALS AND PROGRAMMING IN C | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 109** | **Course Credits:** | **3** |
| **Course Category:** | **CC1** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester** | **1U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. Knowledge of basics of computers |
| 2. A general understanding of I/O Devices |
| 3. Understanding of operating system including memory management |
| 4. Understanding of computer generations and languages |
| 5. Understanding of coding fundamentals |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Understanding the fundamental concepts of computer. |
| 2. Understanding the concept of Computer Organization |
| 3. Understanding the Concept of Memory and data processing |
| 4. Understanding of Analog and Digital Computers |
| 5. Understanding the basic terminologies used in computer programming. |

**Unit I: Basics of Computer**

Computer System Characterization & Capabilities. Computer Hardware & Software, I/O Devices, Types of Software's. Types of Computer: Analog Digital & Hybrid, Computer Generations of Computers, Introduction to PC, Types of PC Systems.

**Unit II: Computer Organization**:

Operating System, Booting, Functions of OS, Types of OS. Storage Fundamentals, Primary and Secondary Storage, Data Storage and Retrieval Methods, Tape Storage and Retrieval Methods, Characteristics & Limitation, Direct Access Storage for Microcomputers- Hard Disks, Disk Cartridge, Direct Access Storage Devices For Large Computer Systems, Mass Storage Systems and Optical Disks CD ROM.

**Unit III: Data Processing**:

Data, Data Processing System, Storing Data, Processing Data. Central Proceeing Unit: The Microprocessor Control Unit, A L. U., Register, Buses Main Memory, Main Memory (Ram) For Microcomputers, Read-Only Memory. Computer Output: Output Fundamentals, Hardcopy Output Devices, Impact Printers, Non-Impact Printer's Plotters, Computer Output Microfilm/Microfiche (Com) System, Softcopy Output Devices, Cathodes Ray Tube And Flat Screen Technologies.

**Unit IV: Computer & System Software:**

System Software Versus Application Software, Type of System. Software's, Introduction Types of Operating System Programs, Booting Loader, Diagnostic Tests, Operating System Executive, BIOS, Utility Programs, File Maintenance, Language Processors, Assembler, Compiler and Interpreter. Applications Software: Microcomputer Software, Interacting With System, Trends In PC Software, Types of Application Software, Difference Between Program And Packages.

**Unit V: Computer Languages:**

Computer Programming Languages, Types of Programming Languages, Generations of Programming Languages Development Low Level Versus High Level Language, Machine Code (Or Machine Language) Advantages of Using Machine Code, Disadvantages of Using Machine Code, Assembly Language, Assembler, Advantages of Assemble Languages, Limitations of Assembly Languages. The Need For Assembly Languages. High Level Languages: Development of Higher Level Languages, Machine Independence and Portability, Advantages of High Level Languages, Problem Oriented Languages. Procedure Oriented Languages, Compilers And Interpreters, Examples of Some High Level Languages, Object Oriented Programming. Fourth Generation Languages, Difference Between a Higher Level & Fourth Generation Languages, Merits And Demerits of 4 Gls, Type of 4 Gls. The Future of 4-Gls, Few Popular 4-Gls, Application Program Generators (Apgs).

**Text Books:**

1. William Stallings, "Computer Organization and Architecture", PHI

**Reference Books:**

1. Computer Fundamentals By P.K. Sinha
2. Fundamental of Computers - By V.Rajaraman B.P.B. Publications
3. Fundamental of Computers - By P.K. Sinha
4. Unix Concepts and Application - By Sumitabha Das
5. MS-office 2000(For Windows) - By Steve Sagman

Computer Today by S.K.Bansandra: Galgotia publication Pvt.Ltd. New Delhi.

| **BASICS OF ARTIFICIAL INTELLIGENCE** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA111** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **2U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. To introduce students to artificial intelligence |
| 2. To introduce the concepts of artificial intelligence to students |
| 3. To familiarize students with flow of artificial intelligence projects |
| 4. To familiarize students with different domains and application areas of artificial intelligence |
| 5. To enable students in implementation of artificial intelligence projects |

| COURSE OUTCOMES |
|---|
| At the end of the course the students should be able to: |
| 1. Understand the artificial intelligence evolution |
| 2. Understand the significant concepts of artificial intelligence |
| 3. Understand the flow of artificial intelligence projects |
| 4. Aware of application areas of artificial intelligence |
| 5. Implement artificial intellligence projects |

**UNIT 1 Introduction**

Introduction to AI, Components of AI, Goals of AI, Types of AI, History of AI, Turing Test in AI, Advantages and Disadvantages of AI, Intelligence, Intelligent System, Role of IS, Comparison of various IS, Weak AI and Strong AI, Mind Body Problem in AI, Chinese Room Experiment in AI, Parallel and Distributed AI.

**UNIT II Agents in AI**

Intelligent Agents, Types of AI Agents, Simple Reflex Agent,Model-based reflex agent, Goal-based agents, Utility-based agent, Learning agent, Structure of an AI Agent, Agent Environment in AI, Examples of Agents, Knowledge Engineering, Knowledge Based System, Knowledge Engineering Techniques, Knowledge Engineering Principles, Knowledge Engineering Methodology.

**UNIT III Searching Techniques and AI problems**

Searching in AI, Search Algorithm Terminologies, Properties of Search Algorithms, Breadth-first search, Depth-first search, Best First Search, Tic-Tac Toe Problem, Water Jug problem, Chess Problem, Tower of Hanoi problem, Travelling Salesman problem, Monkey and Banana Problem, Magic Square.

**UNIT IV Knowledge Representation**

Knowledge Representation Definition, Declarative Knowledge, Procedural knowledge, Meta Knowledge, Heuristic Knowledge, Structural Knowledge, Inheritable Knowledge, Inferential Knowledge, Relational Knowledge, Explicit Knowledge, Tacit Knowledge, Uncertain Knowledge, Knowledge Storage, Relation between Knowledge and Intelligence, AI knowledge cycle.

**UNIT V AI Techniques and applications**

Introduction to Machine Learning, Introduction to Deep Learning, Introduction to Expert system, Introduction to Natural Language Processing, AI in future, AI in social Media, AI in Entertainment and education, AI in drones, AI in Automated Computer support, AI in personalized shopping experience, AI in Finance, AI in smart Cars, AI in travel and navigation, AI in smart home devices, AI in security and surveillance, Ai in education, AI in health care, AI in E commerce.

**Text Books:**


1. Artificial Intelligence, Elaine Reich: Tata Mcgraw Hill publishing house, 2008.
2. Artificial Intelligence, Ela Kumar, IK Publishing.
3. Artificial Intelligence, Peterson, TataMcGraw Hill, 2008.
4. Artificial Intelligence, Russel and Norvig, Pearson Printice Hall Publication, 2006.
5. Artificial Intelligence, Winston, PHI publication, 2006.
6. Artificial Intelligence- A modern approach (3rd Edition) By Stuart Russell & Peter Norvig.
7. Artificial Intelligence: The Basics By Kevin Warwick

| INTRODUCTION TO WEB TECHNOLOGY | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA113** | **Course Credits:** | **3** |
| **Course Category:** | **CC3** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **1 U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. Become familiar with basic Overview of Internet and Web technology. |
| 2. Become familiar with Web Designing. |
| 3. Become Familiar with the Browsing tools and technologies. |
| 4. Understanding JavaScript and its significance for Internet and web technology. |
| 5. Understanding of XML and its functionalities |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Understanding basics of Internet and web technology. |
| 2. Understanding the role and significance of Internet and web technology |
| 3. Applying internet technology in web technology. |
| 4. Designing internet applications using different web languages |

## UNIT I OVERVIEW OF INTERNET AND WEB

Introduction to Internet, history of Internet and web, Internet services and accessibility, uses of the Internet, Internet standards, Internet protocols- IP, TCP,UDP and host names, web server, proxy server, fast ready connections on the web, web browsers, Netscape communication suite, Microsoft Internet explorer, firewalls, data security.

**UNIT II WEB DESIGN**

Key issues in web site design, introduction to HT.ML, SGML- DID, DID elements, attributes, outline of an HTML document, head section- prologue, link, base, meta, script, style, body section- headers, paragraphs, text formatting, linking, internal linking, embedding images, lists, tables, frames, other special tags and characters, XHT.ML, XML, structuring data, XML schema documents, document object model, security and management issues for creating a website.

**UNIT III BRO\VSING SYSTEMS**

Searching and web casting technique, popular web servers, basic features, bookmarks, cookies, progress indicators, customization of browsers, browsing tricks, next generation web browsing, search engines, architecture of search engines, search tools, web crawlers, types of crawlers, scalable web crawler, incremental crawler, parallel crawler, focused crawler, agent based crawler, case study ofIE, counters, Internet chat, hardware and software requirements for Internet and web based applications, Internet and web technologies.

**UNIT IV JAVASCRIPT**

Introduction, Language elements, objects of JavaScript, other objects like data, math, string, regular expressions, arrays.

**UNIT V XML**

The origins of XML, The motivation for XML, XML objectives, the advantages of XML, XML describes data, Data storage and XML, E-publishing and XML, Single source documentation, Browser support, Well-formed XML documents, Requirements for well-formed XML documents, Plain text versus well-fo1med XML, Valid XML documents.

**Reference Books:**

1. Raj Kamal, Internet and Web Technologies, TMH, 2005.
2. Monica D'Souza, Web publishing, TMH, 2001.
3. David Crowder and Rhonda Crowder, Web Design, IDG Books India, 2001.
4. Musciano C., HT.ML and XHTML the Definitive Guide, 6th edition, OReilly, 2006.
5. Deitel H.,Deitel P., Internet and World Wide Web: How to Program, 4 edition, PHI.

| LOGICAL ORGANIZATION OF COMPUTER | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA107** | **Course Credits:** | **4** |
| **Course Category:** | **CC4** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **1U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 01** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 15** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| **1.** Understanding of digital representation of data in a computer system. |
| **2.** Understand the general concepts in digital logic design, including logic elements. |
| **3.** Understanding of combinational and sequential logic circuit design. |
| **4.** Understanding of computer arithmetic formulate and solve problems. |
| **5.** Understand the performance requirements of systems. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| **1.** Understand of combinational and sequential circuits. |
| **2.** Understand register transfer and micro operations. |
| **3.** Learn various types of memories used in computers. |
| **4.** Understand processor design. |
| **5.** Learn about processor design and its architectures. |

**UNIT I: Introduction:**

Types of computers: Analog, Digital and Hybrid Computers, Modern Digital Computer. Digital logic circuits and Components: Logic gates, Boolean Algebra, K-Map Simplification, Half Adder, Full Adder, Decoder, Encoders, Multiplexers, Demultiplexer, Flip Flops, Registers, Binary Counters.

**UNIT II: Register Transfer & Micro operation:**

Register Transfer Language, Bus and Memory Transfer, Bus Architecture, Arithmetic Micro operations: Binary Adder, Binary Subtractor, Binary Adder Subtractor, Binary Increment and Binary Decrement.

**UNIT III: Memory Organization:**

Memory Hierarchy, Main Memory (RAM and ROM), Associative Memory, Cache Memory, Auxiliary Memory. I/O Organization: I/O interface, Modes of transfer, Interrupt handling, Direct Memory Access, Input/ Output processor, Serial Communication.

**UNIT IV: Processor Design:**

General Register Organization, Stack Organization, Addressing Modes, Instruction Formats, Data Transfer & manipulation, Program Control, Reduced Instruction Set Computer and Complex Instruction Set Computer.

**UNIT V**: **Parallel Processing**:
Introduction, Linear and Nonlinear Pipeline Processors, Super Scalar and Super Pipeline Design, Vector Processing, Array Processors, Super Computer.

**Text Books:**

1. Mano M., "Computer System Architecture"
2. William Stallings, "Computer Organization and Architecture", PHI

**Reference Books:**

1. Mano M., "Digital Logic and Computer Design"
2. Kai Hwang, "Advanced Computer Architecture", McGraw Hill.

| C PROGRAMMING LAB | | | |
|---|---|---|---|
| **Course Code:** | **BCA185** | **Course Credits:** | **2** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **1U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **--** |
| **Total No. of Lectures (L + T):** | **15** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1 To develops fundamental understanding C programming environment. |
| 2 To create programming logics and learn C language programming concepts. |
| 3 To design and develop algorithms and programs with different data declarations, initialization and loop operations. |
| 4 To develop the ability to define and manage functions, array, structures, pointers etc. based on program objective. |
| 5 To understand and develop C programs to handle computer files, their usage and perform various operations on files. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1 Understand the C programming fundamentals. |
| 2 Understand the use of various programming concepts and techniques. |
| 3 Understand the C data types and operators with their applications. |
| 4 Understand C by using arrays, functions, structures and union. |
| 5 Develop the Programs in C using its advance features. |

**LIST OF EXPERIMENTS:**

1. Write a program to find the sum (arithmetic operations) of the two integers.
2. Write a program to demonstrate the loops (while, do_while and for) execution.
3. Write a program to compute the simple and compound interest.
4. Write a program to calculate factorial of a number using recursion.
5. Write a program to find the reverse of a given number.
6. Write a program to check whether the year is leap or not.
7. Write a program to take marks of a student of 5 subjects as an input and print the grade.

marks<40 = FAIL
marks>=40 and <=59 =GOOD
marks>=59 and <80 =EXCELLENT
marks>=80 = OUTSTANDING

8. Perform program number 5 using switch case statement.
9. Write a program to compute the length of a string using While Loop.
10. Write a program to print the following pattern: -

a.
```
*
**
***
****
*****
```

b.
```
*
* *
* * *
* * * *
```

c.
```
0
1 2
3 4 5
6 7 8 9
```

11. Write a program to illustrate the difference between call by value and call by reference.
12. Write a program to check whether a given string is palindrome or not.
13. Create a structure called STUDENT having name, reg. no., class and age as its field.
14. Write a program to compute the length of a string using pointers.
15. Write a program to create a file, input data and display its content.

| **WEB TECHNOLOGY LAB** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 187** | **Course Credits:** | **2** |
| **Course Category:** | **CC-L1** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **1U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **3** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **10** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |

| |
|---|
| **1.** HTML fundamentals. |
| **2.** Basic understanding of graphic production with a specific stress on creating graphics for the Web. |
| **3.** A general grounding introduction to more advanced topics such as programming and scripting. |
| **4.** Explore the basic tools and applications used in web publishing. |
| |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| **1**. Analyze a web page and identify its elements and attributes. |
| **2.** Create web pages using XHTML and Cascading Style Sheets (CSS). |
| **3**. Build dynamic web pages using Javascript (Client side programming). |
| **4.** Create XML documents and Schemas. |

1. Write an HTML code to display your education details in a tabular format.
2. Write an HTML code to display your CV on a web page.
3. Write an HTML code to create a Home page having three links : -
   About Us, Our Services and Contact Us. Create separate web pages for the three links.
4. Write an HTML code to create a login form. On submitting the form, the user should get navigated to a profile page.
5. Write an HTML code to create a Registration Form. On submitting the form, the user should be asked to login with these new credentials.

6. Write an HTML code to create your Institute website, Department Website and Tutorial website for specific subjects.
7. Write an HTML code to illustrate the usage of the following:
    - Ordered List
    - Unordered List
    - Definition List
8. Write an HTML code to create a frameset having header, navigation and content section.
9. Write an HTML code to demonstrate the usage of inline CSS.
10. Write an HTML code to demonstrate the usage of internal CSS.
11. Write an HTML code to demonstrate the usage of external CSS.
12. Design HTML form for keeping student records.
13. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
14. Write a program in XML and create a style sheet in CSS & display the document in internet explorer.
15. Write an XML program to display products.

# SEMESTER II

| Fundamentals of Operating System | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA110** | **Course Credits:** | **3** |
| **Course Category:** | **CC2** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester (U / P):** | **1U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

**COURSE OBJECTIVES**

1. To study and apply concepts relating to operating systems
2. Understand the concepts of process management
3. Understand the concepts of memory management and how to map it.
4. Study of Deadlock and how to avoid it
5. Understanding the concepts of various device and disk managements

**COURSE OUTCOMES**

At the end of the course the students should be able to:

1. The student should be able to understand basics of Operating System,Different types os OS,and importance of OS
2. The student should be able to describe the working of process in detail , how cpu schedule and how dead lock occur and prevent from deadlock
3. The student should be able to understand the concepts and implementation Memory management policies and virtual memory
4. The student should be able to understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS
5. The student should be able to understand the working of file management how data is stored into memory and how it will transmit from one side to another in computer system

**UNIT I- Introduction to Operating System**

Introduction to OS, Its need and operating system services, Operating system Classification – Single user, Multi user, Simple batch Processing, Multiprogramming, Multitasking, Parallel systems, Distributed system & Real time system (overview).

**UNIT II- Process Managements**

Process Concept, Interprocessor communication- Race conditions –Critical Sections –Mutual Exclusion –Busy waiting – Sleep and Wakeup – semaphores- Event counter – Monitors- Message passing, Threads, Process scheduling & CPU scheduling – Round robin scheduling – priority scheduling – multiple queues- shortest job first- guaranteed scheduling- two –level scheduling.

**UNIT III- Memory Managements**

Logical versus Physical Address space, Swapping –Multiprogramming with fixed and variable partitions- Memory management with bit maps, linked list, buddy system- allocation of swap space. Virtual memory- paging and segmentation, page tables, associative memory- inverted page tables. Allocation algorithm, Page replacement algorithm, thrashing.

**UNIT IV-File System**

File systems and I/O files. Directories- file system implementation- security and protection mechanisms. Principles of I/O hardware – I/O devices- device controllers-DMA. Principle of I/O software – Interrupt handles- device drivers – Disk Scheduling- Clock and terminals. I/O buffering

–RAID –Disk cache, FCFS scheduling , SSTF scheduling, SCAN Scheduling, C- SCAN scheduling, Selecting disk scheduling algorithms,

**UNIT V- DeadLock**

Deadlock - conditions for deadlock. Deadlock detection and recovery. Deadlock avoidance - resource trajectories - safe and unsafe states - bankers' algorithm. Deadlock prevention. Two phase locking – non-resource deadlocks – starvation, security mechanism and policy, Domain of protection, access matrix.

**Text Books:**

1. Milenekovie , "Operating System Concept", McGraw Hill.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (ASIA) Pvt. Ltd.

**Reference Books:**

1. Harvey M. Deitel, Paul J. Deitel, and David R. Choffnes, "Operating Systems", Prentice Hall.
2. Petersons, "Operating Systems", Addision Wesley.

| **FUNDAMENTALS OF DATA SCIENCE** | | | |
|---|---|---|---|
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| **Course Code:** | **BCA 112** | **Course Credits:** | **3** |
| **Course Category:** | **CC6** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1U** | **Course Semester** | **1U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. Knowledge of basics of data science. |
| 2.Describe the significance of data science and understand the Data Science process |
| 3. Explain how data is collected, managed and stored for data science |
| 4.Build, and prepare data for use with a variety of statistical methods and models |
| 5. Analyze Data using various Visualization techniques |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Summarize testable predictions for real-time data. |
| 2. Understand the concepts of Data collection and management |
| 3. Identify distribution properties of data using statistical concepts. |
| 4.Evaluate models for multiple environments. |
| 5. Understand regression techniques |

**UNIT – I** Introduction To Data Science: Definition, Big Data and Data Science Hype, Datafication Data Science Profile, Meta-Definition, Data Scientist, Statistical Inference, Populations and

Samples, Populations and Samples of Big Data, Big Data Can Mean Big Assumptions, Modeling, Philosophy of Exploratory Data Analysis, The Data Science Process

**UNIT –II** Mathematical Preliminaries:Probability,Descriptive Statistics, Correlation Analysis. Data Munging: Properties of Data, Languages for Data Science, Collecting Data, Cleaning Data, Crowdsourcing.

**UNIT – III** Scores and Rankings: Developing Scoring Systems, Z-scores and Normalization, Advanced Ranking Techniques Statistical Analysis: Sampling from Distributions, Statistical Distributions, Statistical Significance, Permutation Tests and P-values

**UNIT- IV** Visualizing Data: Exploratory Data Analysis, Developing a Visualization Aesthetic, Chart Types, Great Visualizations Mathematical Models: Philosophies of Modeling, A Taxonomy of Models, Baseline Models, Evaluating Models, Evaluation Environment.

**UNIT-V** Supervised Learning: Linear Regression, Better Regression Models, Regression as Parameter Fitting, Simplifying Models through Regularization Classification and Logistic Regression, Issues in Logistic Classification, Naive Bayes, Decision Trees Classifiers

**TEXT BOOKS:**

1. Steven S. Skiena, “The Data Science Design Manual”, Springer 2017.
2. Rachel Schutt & O’neil, “Doing Data Science”, Straight Talk from The Frontline O’REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

**REFERENCE BOOKS**

1. Joel Grus,” Data Science from Scratch” First Edition, April 2015
2. Gareth James, Daniela Witten, Trevor Hatie, RoberstTibhirani , “An Introduction to Statistical Learning-with Applications in R“, 2013
3. Jure Leskovec, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2 edition (30 September 2014)
4. R Programming for Data Science, Roger D. Peng, LeanPub, 2015.

**WEB REFERENCES:**

1. “Data science for engineers” https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/

| SYSTEM ANALYSIS & DESIGN | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 106** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **P** |
| **Course Year (U / P):** | **1P** | **Course Semester** | **2P** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. To determine the specific needs of a system. |
| 2. Discuss different approaches and tasks for development of a system. |
| 3. Evaluate different tools and techniques. |
| 4. Use appropriate methods and techniques to design information systems. |
| 5. System analysis means to tradeoff between functional requirements of a sub-system (components) and its immediately related sub-systems. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Describe principles, concepts and practice of System Analysis and Design process |
| 2. Describe the systems analysis and systems development life cycle |
| 3. Conduct a feasibility analysis of a system |
| 4. Analyze and develop the project strategy |
| 5. To be able to apply the tools and techniques of system analysis for organizational design in practice. |

**Unit 1: Basic Concept of Systems:** The System: Definition and Concepts; Elements of a System: Input, Output Processor, Control, Feedback, Environment, Boundaries and Interface; Characteristics of a System; Types of systems -Physical and Abstract System, Open and Closed Systems, Man-made Systems; Information and its categories.

**Unit 2: System Development Life Cycle:** Introduction to SDLC, Various phases: study, analysis, design, development, testing, implementation, maintenance; System documentation: Types of documentation and their importance.

**Unit 3: Feasibility Study & Tools for System Analysis:** Definition, Importance of feasibility study, Types of feasibility study, System selection plan and proposal, Prototyping, Cost-Benefit Analysis: Tools and Techniques.
Data Flow Diagram (DFD), Logical and Physical DFDs, Developing DFD; System Flowcharts and Structured charts.

**Unit 4: Detailed design and Testing & Quality assurance:** Introduction, Module specification, File Design, Database concepts & Design.
Introduction to testing, Need of testing, types of test, nature of test data, test plan, system testing & types of system tests, Quality assurance.

**Unit 5: System Implementation and Maintenance & System Security and Audi**t: Need of System Testing, Types of System Testing, Quality Assurance; System Conversion, procedures and controls,

System evaluation and performance, Maintenance activities and issues.
System Security, Threats, Control measures, System Audit, Disaster Recovery Planning.

**TEXT BOOKS:**

1. James, A.S, Analysis and design of information systems, McGraw hill, New York, 1997
2. 'A' Level made simple Structured System Analysis and Design, BPB publications: Dr.Madhulika Jain,Vineeta Pillai, Shashi Singh, Satish Jain.
3. Effective Methods for Software Testing, William E.Perry
4. System Analysis & Design by S.K Jha: SK Kataria & sons.
5. Perry Edwards: System Analysis & design Mc-Graw Hill

**REFERENCE BOOKS:**

1. Venkata rao,v., System Analysis, design & MIS,BPB publications, 2000
2. Awad, Elias.,analysis and design, Galgotia publications pvt.Ltd.1998
3. Elias m. Awed: System Analysis and Design

**WEB REFERENCES:**

1. **https://www.tutorialspoint.com/system_analysis_and_design/index.htm**
2. **https://www.ddegjust.ac.in/studymaterial/pgdca/ms-04.pdf**
3. **https://www.studocu.com/row/document/technical-and-vocational-teachers-college/system-analysis-and-design/unit-1-lecture-notes-1/7448343**
4. **https://www.analyticssteps.com/blogs/what-system-analysis-and-design**

| DIGITAL LOGIC | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 108** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **P** |
| **Course Year (U / P):** | **1P** | **Course Semester** | **2P** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **2** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. To Understand the concept of Digital system | | | |

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|---|
| 2. To Understand the concept of a combination logic circuit- Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, look-ahead Carry adder. Decoders, Encoders, multiplexers and de-multiplexers. |
| 3. Understand the concept of Sequential logic circuit- Flip-flop, shift register and counter. |
| 4. Understand the concept of MemoriesMemory organization, Classification and Characteristics of memories,-ROM, PROM, EPROM, EEPROM, and PLD. |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1. Understand the concept of Digital system |
| 2. The students will understand Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, look-ahead Carry adder. Decoders, Encoders, multiplexers and de-multiplexers. |
| 3. Understanding of Sequential logic circuit- Flip-flop, shift register and counter |
| 4. Understanding of Memory organization, Classification and Characteristics of memories,-ROM, PROM, EPROM, EEPROM, and PLD. |

**UNIT I: INTRODUCTION**

Review of Number systems and Binary codes, Binary arithmetic: addition, subtraction, multiplication and division algorithms. Logic gate, Boolean algebra: theorems and functions, Simplification of Boolean functions, minimization techniques, Karnaugh's map method,Quine and McCluskey's method, realization of boolean function using universal gates.

**UNIT II:CONBINATION LOGIC CIRCUIT**

Analysis and design of combination circuits, Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, look-ahead Carry adder. Decoders, Encoders, multiplexers and de-multiplexers.

**UNIT III: FLIP –FLOP**

R-S, Clocked R-S, T, D, J-K, race around problem, Master-slave flip-flop., State and Excitation Tables, Flip-flop conversions.

**UNIT IV: SHIFT REGISTER & COUNTERS**

synchronous and asynchronous counters, Binary ripple counter, up-down counter, Johnson and ring counter, Analysis and Design of Sequential Circuits, SISO, SIPO, PISO, PIPO soft registers.

**UNIT V: SEMICONDUCTOR MEMORY**

Memory organization, Classification and Characteristics of memories, ROM, PROM, EPROM, EEPROM, and PLD.

**Text Books:**

1. M. Mano :Digital Logic and Computer Design, Pearson Education
2. William I. Fletcher :An Engineering Approach to Digital Design, Pearson Education
3. R.P. Jain: Digital Electronics, TMH

**References:**

1. W.H. Gothman : Digital Electronics, PHI.
2. Millman and Taub : Pulse, Digital and Switching Waveforms, MGH
3. Anand Kumar : Pulse and Digital Circuits , PHI
4. Leach and Malvino : Digital Principles and Applications, TMH

**WEB REFERENCES:**

1. https://www.shahucollegelatur.org.in/Department/Studymaterial/sci/it/BCA/FY/digielec.pdf
2. https://www.web.mit.edu/viz/EM/visualizations/coursenotes/modules/guide02.pdf
3. https://www.pdfdrive.com/digital-electronics-books.html

**E-TEXT BOOKS:**

1. http://www.freebookcentre.net/Language/Free-Digital Electronics -Download.htm
2. http://www.imada.sdu.dk/~svalle/courses/dm14-2005/mirror/c/
3. https://mrcet.com/downloads/digital_notes/IT/DIGITAL%20LOGIC%20DESIGN%20(R17A0461).pdf

| **Operating System Lab** | | | |
|---|---|---|---|
| Course Code | BCA186 | Course Credit | 02 |
| Course Category | CC-L | Course(U/P) | U |
| No of lab (Hrs./Week) | 03 | Mid Semester Exam Hours: | 1U |
| Total no of lab(L+T) | 10 | End Term Exam Hours: | 3U |
| **COURSE OBJECTIVES** | | | |
| 1. The objective of this course is to introduce students to the foundation of operating system. | | | |
| 2. Introduction to process management | | | |
| 3. Working knowledge of memory management. | | | |
| 4. Working knowledge of contagious memory allocation techniques | | | |
| 5. Working knowledge of deadlock and Disk scheduling | | | |
| **Course Outcomes** | | | |
| At the end of the course the student should be able to understand the : | | | |
| 1.Simulation of Banker's Algorithm for Deadlock Avoidance ,Prevention | | | |
| 2. Simulation of MVT and MFT. | | | |
| 3. Simulation of contagious memory allocation | | | |
| 4. Simulation of all file organization techniques | | | |
| 5. Simulatin of paging Techniques of memory management | | | |

1. Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.

a) FCFS

b) SJF

2. Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

3. Write a C program to simulate the following file allocation strategies.

a) Sequential

b) Indexed

4. Write a C program to simulate the MVT and MFT memory management techniques.

5. Write a C program to simulate the following contiguous memory allocation techniques

a) Worst-fit

b) Best-fit

6. Write a C program to simulate paging technique of memory management.
7. Write a C program to simulate the following file organization techniques

a) Single level directory

b) Two level directory

c) Hierarchical

8. Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.
9. Write a C program to simulate disk scheduling algorithms

b) FCFS

c) SCAN

| **MS-EXCEL LAB** | | | |
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| **Course Code:** | **BCA 188** | **Course Credits:** | **2** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **1P** | **Course Semester** | **2P** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **NO** |
| **Total No. of Lectures (L + T):** | **10 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. Understand the basics and functions of MS excel | | | |
| 2. Clear understanding and use of data validations and templates. | | | |
| 3. Purpose of sorting and filtering features. | | | |
| 4. Use of reports in business organizations. | | | |
| 5. Purpose and advantage of charts for top management in any work place. | | | |
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| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1. Learn to understand the functions in Excel. | | | |
| 2. Understand the validations. | | | |
| 3. Make reports in excel. | | | |
| 4. Learn to work with different formulas | | | |
| 5. Learn how to make charts in MS excel. | | | |

LIST OF EXPERIMENTS

1. Introduction and installation of MS Excel in detail

2. Basic arithmetic functions like sum, multiplication, fraction, Min, Max and percentage, etc

3. Advanced function of MS Excel like Upper , Lower, Average, and Concatenation

4. Other functions of MS Excel like Left, Right, Mid, Len, and Find

5. Entering and editing data, text and values in excel

6. Modifying a worksheet by moving, copying data, copying formulas, inserting and deleting ranges, rows and columns

7. Formatting the text, row and column formatting, conditional formatting

8. Creating charts in excel like Pie chart and Bar chart.

9. Modifying existing worksheet, using shortcut keys, create and email worksheet

10. Preparing to print worksheet, page setup options, and printing worksheet

# SEMESTER-III

| **PYTHON PROGRAMMING** | | | |
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| **Course Code:** | **BCA 201** | **Course Credits:** | **3** |
| **Course Category:** | **CC9** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1 Knowledge of python basics and its features. | | | |
| 2 An understanding of operators, conditions and functions in python. | | | |
| 3 Understanding of string functions & string as object and List functions & list as object. | | | |
| 4 Understanding of tuple, set, dictionary and various python functions. | | | |
| 5 Understanding of Files, OOPs features along with database interaction & error handling. | | | |
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| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1. Student will learn fundamentals of python which is a widely adopted language for machine learning. | | | |
| **2.** Students will be able to work with python string object and functions. | | | |

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| 3. Students will understand the concept of functions and will be able to create their own functions. |
| 4. Students will be able to work with files and OOP concepts. |
| 5. Students will be able to work with database, module and error handling. |

**UNIT I Python Basics, Conditional &Loops**

Installation of Python, Python Variables and expression, Python Objects, Number & Booleans, Strings, Operators - Arithmetic, Bitwise, comparison and Assignment operators. Conditions (If else, if-elif-else), Loops (While, for), Break and Continue statements, Functions provided by python.

**UNIT II String Objects and List objects**

String object basics, String methods, Splitting and Joining Strings, list object basics, list methods, List comprehensions.

**UNIT III Tuples, Set, Dictionaries & Functions**

Tuples, Sets, Dictionary Object basics, Dictionary Object methods. Functions basics in python, Iterators, Lambda functions.

**UNIT IV OOPS concepts & Working with Files**

OOPS basic concepts, Creating classes and Objects, Inheritance, Multiple Inheritance, Working with files, Reading and writing files, Buffered read and write, Other File methods

**UNIT V Modules, Exception Handling & Database Programming**

Using Standard Module, Creating new modules, Exceptions Handling with Try-except, Creating, inserting and retrieving Table, Updating and deleting the data. Descriptive analysis, Pandas Input- output, Pandas manipulation, Pandas groupby

**Text Books :**

1. Head First Python 2e: A Brain-Friendly Guide Paperback – Illustrated, 16 by Paul Barry, Oreilly
2. Python: The Complete Reference Paperback – 20 March 2018 by Martin C. Brown (Author), TMH Publication

| **SOFTWARE ENGINEERING FUNDAMENTALS** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA203** | **Course Credits:** | **3** |
| **Course Category:** | **CC10** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
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| **COURSE OBJECTIVES** | | | |
| 1 Knowledge of basic software engineering and process paradigm. | | | |
| 2 A General understanding of SRS document and requirement gathering techniques. | | | |

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| 3 Understanding of design process, ERD, DFD, use case diagrams. |
| 4 Understanding of SDLC model and different process models for software development. |
| 5 Understanding of testing mechanism and maintenance methodology. |
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| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1 Basic knowledge and understanding of the software engineering discipline. |
| 2 Ability to apply software engineering principles and techniques. |
| 3 Ability to prepare SRS document and prepare the design document for the software project problem. |
| 4 To produce efficient and reliable solutions for software project problems. |
| 5 Ability to perform study and provide tested deliverable product for the given problem. |

**UNIT I SOFTWARE ENGINEERING**

Introduction to software engineering: definitions, role of software engineering, planning a software project, defining the problem, developing a solution strategy, planning the development process, software engineering process paradigms, principles of software engineering, software project management.

**UNIT II REQUIREMENT ANALYSIS AND DESIGN**

Software Requirement Specification (SRS): Introduction, need of SRS, significance, characteristics of SRS, Structure of SRS, IEEE standards for SRS design, functional and non-functional requirements, Requirement gathering and analysis, requirement engineering and management.

**UNIT III SOFTWARE DESIGN PROCESS**

Software Design: Introduction, design process activities: architectural design, Abstract specification, Interface design, component design, data structure design, algorithm design modular approach, top-down design, bottom-up design, design methods: data-flow model: data flow diagram, entity-relation-attribute model: E-R diagram, structural model: structure charts, context diagrams, object models: use case modeling, use case diagrams, sequence diagrams, cohesion and coupling.

**UNIT IV SOFTWARE LIFE CYCLE MODELS**

Software Development Life Cycle (SDLC), SDLC models, waterfall model and its variations, prototype model, iterative enhancement model, spiral model, RAD model, comparison of these models, software development teams, software development environments, validation and traceability, maintenance, prototyping requirements, Software project management.

**UNIT V SOFTWARE TESTING AND MAINTENANCE**

Testing Methods: unit testing, integration testing, system testing, acceptance testing, testing techniques: white box testing, black box testing, thread testing, regression testing, alpha testing, beta testing, static testing, dynamic testing, Evolution of software products, economics of maintenance, category of software
maintenance, Role of product development life cycle, deployment model, adaptive maintenance, corrective maintenance, perfective maintenance, enhancement request, proactive defect prevention, problem reporting, problem resolution, software maintenance from customers' perspective, maintenance standard: IEEE-1219, ISO-12207.

**Reference Books:**


1. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, New Delhi 1997.
2. Ian Sommerville, Software Engineering, Pearson Education, 2009.
3. Pressman Roger S., Software Engineering: Practitioner's Approach, McGraw-Hill Inc., 2004.
4. Software Engineering: Software Reliability, Testing and Quality Assurance, Nasib S. Gill, Khanna Book Publishing Co (P) Ltd., New Delhi, 2002.


| **INTRODUCTION TO DATABASE MANAGEMENT SYSTEM** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA205** | **Course Credits:** | **3** |
| **Course Category:** | **CC11** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. Understand the basic concepts and the applications of database systems. | | | |
| 2. Master the basics of SQL and construct queries using SQL. | | | |
| 3. Understand the relational database design principles. | | | |
| 4. Familiar with the basic issues of transaction processing and concurrency control. | | | |
| 5. Familiar with database storage structures and access techniques | | | |
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| **COURSE OUTCOMES** | | | |
| 1. At the end of the course the students should be able to: | | | |

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| 2. Describe the fundamental elements of relational database management systems |
| 3. Design ER-models to represent simple database application scenarios |
| 4. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data |
| 5. Improve the database design by normalization. |
| 6. Able to explain the principle of transaction management design, concurrency control and recovery algorithms. Applies transaction processing mechanisms in relational databases. |

**UNIT I DATA BASE SYSTEM**

Data base system vs. file system, view of data, data abstraction, instances and schemas, data models, ER model, relational model, database languages, DDL, DML, ER diagrams, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model.

**UNIT II RELATIONAL DATA BASE MODEL**

Introduction to the relational model, integrity constraint over relations, enforcing integrity constraints, querying relational data, and logical data base design, destroying /altering tables and views. Relational algebra and calculus: relational algebra, selection and projection set operations, renaming, joins, division

**UNIT III SQL QUERY**

Basic SQL queries, nested queries, correlated nested queries set, comparison operators, aggregative operators, NULL values, comparison using null values, logical connectivity's, AND, OR and NOTR, impact on SQL constructs, outer joins, disallowing NULL values

**UNIT IV NORMAL FORM**

Problems caused by redundancy, decompositions, problem related to decomposition, reasoning about FDS, FIRST, SECOND, THIRD normal form, BCNF, lossless join decomposition, dependency preserving decomposition, schema refinement in data base design.

**UNIT V TRANSACTION MANAGEMENT**

ACID properties, transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions

**References Books:**

1) Elmasri Navrate, Data Base Management System, Pearson Education, 2008.
2) Raghurama Krishnan, Johannes Gehrke, Data Base Management Systems, TMH, 3rd edition, 2008.
3) C. J. Date, Introduction to Database Systems, Pearson Education, 2009.
4) Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.

Rob, Coronel & Thomson, Database Systems Design: Implementation and Management, 2009

| INTRODUCTION TO DATA STRUCTURE | | | |
|---|---|---|---|
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| **Course Code:** | **BCA207** | **Course Credits:** | **3** |
| **Course Category:** | **CC12** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| **1.** To impart the basic concepts of data structures and algorithms. |
| **2.** To understand concepts about searching and sorting techniques. |
| **3.** To Understand basic concepts about stacks, queues, lists, trees and graphs. |
| **4.** To understanding about writing algorithms and step by step approach in solving problems with data structures. |
| **5.** To understanding different applications of various data structures. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| **1.** Ability to analyze algorithms and algorithm correctness. |
| **2.** Ability to have knowledge of hashing and collision resolution techniques. |
| **3.** Ability to describe stack, queue and linked list operation. |
| **4.** Ability to have knowledge of tree and graphs concepts. |
| **5.** Ability to summarize searching and sorting techniques. |

## UNIT I INTRODUCTION

Data types in C, pointers in C, one dimensional array, Implementing one dimensional array, two dimensional array ,structure parameters, allocation of storage and scope of variables, recursive definition and processes: factorial function, recursion in C, efficiency of recursion, hashing: hash function, open hashing, closed hashing: linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

**UNIT II STACK, LINKED LIST**

Stack definition and examples, push and pop operation implementation, queue as ADT, C Implementation of queues, insert operation, priority queue, array implementation of priority queue, Linked List, , circular and doubly linked list.

**UNIT III TREES REPRESENTATION**

Binary trees: operations on binary trees, applications of binary trees, binary tree representation, node representation of binary trees, implicit array representation of binary tree, binary tree traversal in C, threaded binary tree, C representation of trees, tree traversals, evaluating an expression tree, constructing a tree.

**UNIT IV SEARCHING AND SORTING**

General background of sorting: efficiency considerations, notations, efficiency of sorting, bubble sort; quick sort; selection sort, biheap sort, heap as a priority queue, sorting using a heap, heap sort procedure, insertion sorts: simple insertion

**UNIT V GRAPHS**

Application of graph, C representation of graphs, transitive closure, Warshall's algorithm, shortest path algorithm, linked representation of graphs, traversal methods for graphs, spanning forests, undirected graph and their traversals, depth first traversal, application of depth first traversal, efficiency of depth first traversal, breadth first traversal, minimum spanning tree,

**Text Books:**

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures using C',
   Pearson Education, 2004 / PHI.

**References Books:**

2. E. Balagurusamy, 'Programming in Ansi C', Second Edition, TMH, 2003.
3. Robert L. Kruse, Bruce P. Leung Clovis L.Tondo, 'Data Structures and Program Design in C',
   Pearson Education, 2000 / PHI.

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| DISCRETE STRUCTURE | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA209** | **Course Credits:** | **3** |
| **Course Category:** | **CC13** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| **1.** Write an argument using logical notation and determine if the argument is or is not valid. |
| **2.** Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described. |
| **3.** Write an argument using logical notation and determine if the argument is or is not valid. |
| **4.** Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described. |
| **5.** Understand the basic principles of sets and operations describe. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| **1.** Use logical notation. |
| **2.** Perform logical proofs |
| **3.** Apply recursive functions and solve recurrence relations. |
| **4.** Determine equivalent logic expressions |
| **5.** Apply basic and advanced principles of counting. |

**Unit-1 SET THEORY**

Definition of sets, countable and uncountable sets, Venn Diagrams, general identities on sets. Relation: Definition, types of relation, composition of relations, Pictorial representation of relation, equivalence relation, partial ordering relation. Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, operations of functions, Mathematical Induction

**Unit-2 Lattices**: **LATTICES**

Introduction, ordered set, properties of Lattices: complemented, Modular lattices, Hasse Diagram: Hasse diagram of partially, ordered set, well ordered set.

**Unit-3 BOOLEAN ALGEBRA**

Basic definitions, Sum of Products and Product of Sums, Form in Boolean Algebra, Logic gates and Karnaugh maps.

**Unit-4 PROPOSITIONAL & PREDICATE LOGIC**

Propositional, truth tables, Tautology, Contradiction, Algebra of proposition, theory of inference, theory of predicates, first predicate formula, Quantifiers, types of quantifiers, inference theory of predicate logic

**Unit-5 RECURRENCE RELATION**

Introduction, methods of solving recurrences, Combinatorics: introduction, counting technique, Pigeonhole principle

| BASICS OF DIGITAL MARKETING | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA211** | **Course Credits:** | **3** |
| **Course Category:** | **CC14** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| **1.** The aim of the Digital Marketing Course is to provide students with the knowledge about business advantages of the digital marketing and its importance for marketing success. |
| **2.** The application of the gained knowledge, skills and competences will help future managers in forming digital marketing plan in order to manage a digital marketing performance efficiently. |
| **3.** it helps the marketer to reduce the cost, it helps the marketer to target the proper segment of consumer, it helps the marketer in the better understanding STP process |
| **4.** Make business decisions from the metrics available in Digital Marketing. |
| **5.** Understand mobile marketing measurement and analytics. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| **1.** Understanding of Digital Marketing and Media Concepts. |
| **2.** Identify the importance of digital marketing for marketing success |
| **3.** Identifying digital channels, their advantages and limitations. |
| **4.** To manage relationships across all digital channels and build better customer relationships. |
| **5.** Implement best practices for creating, measuring, and optimizing display ad campaigns. |

**UNIT I Introduction to Digital Marketing:**

The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, Digital Marketing Vs Traditional Marketing, Digital Marketing importance and its components, how digital marketing is adding value to business, ROI of digital strategies.

**UNIT II Social Media Marketing**

Introduction to Blogging, Create a blog post project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns.

**UNIT III Digital Channels:**

Understanding the relationship between content and branding and its impact on sales, search engine marketing (SEM), mobile marketing, video marketing, e-mail marketing, content

marketing and affiliate marketing. Online campaign management; using marketing analytic tools to segment, target and position;

**UNIT IV Search Engine Optimization:**

Understanding search engine, on-page search engine optimization and off-page search engine optimization; Search Engine Marketing (SEM): Google Ads platform, Tools used for SEO, display advertising techniques, My Client Centre (MCC), click through rates (CTR) & pay per click (PPC).

**UNIT-V Digital Marketing Budgeting:**

Resource Planning, cost estimation, cost budgeting and cost control; Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation.

**Textbooks:**

1. Moutsy Maiti: Internet Mareting, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital
4. Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).
5. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).
6. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

| **PYTHON PROGRAMMING LAB** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 281** | **Course Credits:** | **2** |
| **Course Category:** | **CC-L** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **3** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **10** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| **1.** Python fundamentals , basic operations | | | |
| **2.** An understanding of operators, conditions and looping constructs in python. | | | |
| **3.** Understanding of string functions & string as object and List functions & list as object. | | | |
| **4**. Understanding of tuple, set, dictionary and various python functions. | | | |
| **5.** Understanding of Files, OOPs features along with database interaction & error handling. | | | |
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| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |

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|---|
| **1**. Student will learn fundamentals of python , use of operators, loops and python function |
| **2.** Students will be able to work with python string, list, dictionary, set and tuple. |
| **3**. Students will understand the concept of functions and will be able to create their own functions. |
| **4**. Students will be able to work with files and OOP concepts. |
| **5**. Students will be able to work with database, module and error handling. |

1. To print the largest/smallest of two numbers
2. To input three numbers and print the greatest of all
3. To read two numbers x and n and print xn (first write with the use of operator and then write with the help of inbuilt function
4. To input the value of x and n and print the sum of the series: 1+x+x2+x3+x4+…….xn
5. To check if a number is a perfect number or not
6. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)
7. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
8. To print factorial of a number using function
9. To print factorial of a number using recursion
10. To count no of vowels in a string that was given as input by user
11. Write a function to find all duplicates in the list.
12. Write a function unique to find all the unique elements of a list.
13. Write a program to perform addition of two square matrices
14. Write a program to perform multiplication of two square matrices
15. To read from a text file and print each word separated by # symbol, example #vipin # rai

| **DATA BASE MANAGEMENT SYSTEM LAB** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 283** | **Course Credits:** | **2** |
| **Course Category:** | **CC-L** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **2** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **10** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. To explain basic database concepts, applications, data models, schemas and instances. | | | |
| 2. To demonstrate the use of constraints and relational algebra operations. | | | |
| 3. Describe the basics of MYSQL and construct queries using MYSQL | | | |
| 4. To emphasize the importance of normalization in databases | | | |

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|---|
| 5. To facilitate students in Database design |
| |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1. Apply the basic concepts of Database Systems and Applications. |
| **2.** Use the basics of SQL and construct queries using SQL in database creation and interaction |
| 3. Design a commercial relational database system by writing SQL using the system. |
| 4. Develop and evaluate a real database application using a database management system. |
| 5. Use of Views, trigger and procedures. |

1. Write the queries for Data Manipulation and Data Definition Language.
2. Write SQL queries using logical operations and operators.
3. Write SQL query using group by function.
4. Write SQL queries for sub queries, nested queries
5. Write SQL queries to create views.
6. Write an SQL query to implement JOINS.
7. Write a query for extracting data from more than one table.
8. Develop a Library management system, where indexing of book according to the author or alphabetical order can be done. Issuing of books to the student can be managed and searching of books.
9. Make a SQL data base of student details and collaborate it with student semester performance and display each student performance individually.
10. Develop Inventory control and procurements for school management systems. School does have regular purchase of chalk box, chairs, benches etc.

# SEMESTER IV

| FUNDAMENTALS OF JAVA PROGRAMMING | | | |
|---|---|---|---|
| **Course Code:** | **BCA202** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **4U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. To teach principles of object-oriented programming paradigm including abstraction, encapsulation, inheritance, and polymorphism. |
| 2. To impart fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc. |
| 3. To familiarize the concepts of packages and interfaces |
| 4. To facilitate students in handling exceptions. |
| 5. To demonstrate the concept of event handling used in GUI. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP like encapsulation, Inheritance and Polymorphism |
| 2. Design and develop java programs, analyze, and interpret object-oriented data and report results |
| 3. Design an object-oriented system, AWT components and multithreaded processes as per needs and specifications. |
| 4. Participate and succeed in competitive examinations like GATE, Engineering services, recruitment interviews etc. |
| 5. Plan their career in java-based technologies like HADOOP etc. |

**UNIT I OBJECT-ORIENTED PROGRAMMING**

Concept of object-oriented programming (OOP), benefits of OOP, application of OOP, Java history, Java features, Java streaming, Java and Internet, Java contribution to Internet: Java applets, security, portability; Java environment, Java library, Java program structure, Java program, Java Virtual Machine (JVM) architecture, Just In Time compiler (JIT), object-oriented paradigms; abstraction, encapsulation, inheritance, polymorphism, Java class and OOP implementation

**UNIT II DATA TYPE, OPERATORS AND CONTROL STATEMENT**

Data types, Java key words, identifiers, constants, variables, type casting, arithmetic operator, relational operator, logical operator, assignment operator, conditional operator, bitwise operator, ?: operator, arithmetic expressions, expressions, type conversions in expressions, arrays, strings, vectors, wrappers classes, program control statements: if, if….else, switch, looping: while, do….while, for.

**UNIT III CLASSES, OBJECTS AND METHODS**

Java class libraries, class fundamentals, object, methods, adding variables, add methods, creating objects, accessing class members, constructors, methods overloading, overriding methods, final variables and methods, final classes, abstract methods and classes, exception handling fundamental.

**UNIT IV INTERFACES AND PACKAGES**

Interfaces, extending interfaces, implementing interfaces, interfaces ,creating queue interface, variable in interfaces, packages, finding a packages and class path, package and member access.

**UNIT V MULTITHREADING AND APPLET PROGRAMMING**

Multithreading programming: creating threads, thread class and runnable interface extending the thread class, stopping and blocking a thread, life cycle of a thread, thread methods, thread communication using notify(), wait(), and notify all(), applet programming : applet basic, applets architecture, a complete applet skeleton, building applets code, applets life cycle, creating a executable applet,

**Reference Books:**


1. Programming with JAVA, E. Balagurusawamy, Tata McGraw Hill, 1998.
2. JAVA Beginner's guide, Herbert Schildt, Tata McGraw Hill, 2007.
3. Java How to Program, Deitel & Deitel, Prentice-Hall, 1999.
4. The Complete Reference JAVA 2, Herbert Schildt, 5th Edition, Tata McGraw Hill, 2002.
5. The Complete Reference JAVA 2, Herbert Schildt, 7th Edition, Tata McGraw Hill, 2009.
6. The Java Programming Language, Ken Arnold, James Gosling, Addison-Wesley, 1996.
7. How to Program Java, Peter Coffee, Ziff-Davis Press, 1996.


| **FUNDAMENTAL OF MACHINE LEARNING** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | BCA 204 | **Course Credits:** | 3 |
| **Course Category:** | CC | **Course (U / P)** | U |
| **Course Year (U / P):** | 2U | **Course Semester** | 4U |
| **No. of Lectures + Tutorials (Hrs/Week):** | 03 + 00 | **Mid Sem. Exam Hours:** | 1 |
| **Total No. of Lectures (L + T):** | 45 + 00 | **End Sem. Exam Hours:** | 3 |
| | | | |
| **COURSE OBJECTIVES** | | | |
| **1.** To explain the concept of how to learn patterns and concepts from data without being explicitly programmed | | | |
| **2.** To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances. | | | |
| **3.** To explore supervised and unsupervised learning paradigms of machine learning. | | | |
| **4.** To explore dimensionality reduction technique and various feature extraction strategies. | | | |
| **5.** To acquire Data Analysis skills, and Create ML solutions for various problems. | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| **1.** Recognize the characteristics of machine learning that make it useful to real-world problems. | | | |

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|---|
| **2.** To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach. |
| **3.** To mathematically analyze various machine learning approaches and paradigms. |
| **4.** To Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised. |
| **5.** To Understand the concept behind neural networks. |

**Unit 1: Introduction to machine learning**
History of ML, Definition and types of learning: Supervised, Unsupervised, Semisupervised, Reinforcement Learning, need of ML, Data and tools, training, validation and test data, theory of learning – feasibility of learning – error and noise – training versus testing, generalization bound – approximation -generalization tradeoff – bias and variance, Find S algorithm, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

**Unit 2: Supervised Learning Algorithms**
Classification problems, Regression problems: Linear Regression, Logistic Regression, neural networks structures, Multilayer networks, Back propagation Network, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, and support vector machines (SVM).

**Unit 3: Computational Learning Theory and instance-based learning**
Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, Probability theory and Bayes rule. Classifying with Bayes decision theory, Conditional Probability, Bayesian Belief Network, K-nearest neighbor.

**Unit 4: Un-supervised learning, dimensionality reduction**
Introduction to clustering, K- Mean clustering, different distance functions for clustering, Supervised learning after clustering, dimensionality reduction techniques, Principal component analysis.

**Unit 5: Genetic algorithms, Ensemble learning and Measures for Performance of ML algorithms**
Introduction to genetic algorithms, Ensemble Methods (Random Forests: Boosting, Bagging), Classification accuracy, Confusion matrix Misclassification costs, Sensitivity and specificity, ROC curve, Recall, precision, F1 Score, box plot confidence interval.

**Text books:**
**1.** Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
**2**. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
**3.** Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
**4.** Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

**Reference books:**
**1.** Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
**2.** Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
**3.** Christopher Bishop, Pattern Recognition and Machine Learning, Springer.
**4.** Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press.

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|---|---|---|---|
| **Introduction to Information Security** | | | |
| **Course Code:** | **BCA206** | **Course Credits:** | **3** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **4U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1 To develops fundamental understanding of data, information and the security requirements. |
| 2 To create awareness about information security principles, assets and risk management. |
| 3 To learn and understand cryptographic algorithms and related operations. |
| 4 To develop the ability to understand entity verification in networks and web security protocols and applications |
| 5 To Acquire understanding of information security related policies, violations, cybercrimes, laws and standards. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1 Understand the information and the security requirements fundamentals. |
| 2 Understand the security principles and risk management procedure. |
| 3 Understand the cryptographic algorithms with their applications. |
| 4 Understand network and web security protocols. |
| 5 .Understand the requirement of policies, standards, cyber security crimes and laws. |

**UNIT I: Introduction to Information Security:** Definition of information, data, security, need of information security and requirements, CIA, principles of information security, Risk management, Physical security; Asset definition, types of assets, asset classification, Security goals, attacks, services and mechanisms,

**UNIT II: Cryptography**: cryptography: Classical encryption techniques-substitution ciphers and transposition ciphers. Stream and block ciphers. Data encryption standard (DES), Triple DES, Advanced Encryption Standard (AES), Principals of public key crypto systems, RSA & DHKE algorithm.

**UNIT III: Authentication**: Authentication of human entities, machines, messages, authentication requirements, message authentication code, hash functions, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital signature standards (DSS), Key Management and distribution: Symmetric & Public key distribution, Public key Infrastructure.

**UNIT IV: Web Security:** Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME. IP Security, Secure Socket Layer, Secure electronic transaction (SET) System Security: Intrusion & Intrusion detection, Viruses, firewalls.

**UNIT V: Legal Perspectives:** Policy, Types of policies, Need of an Information Security Policy, Standards, Procedures, Guidelines, ISO 27001 Standard. **C**yber-crimes, Types of cyber-crimes, introduction of IT ACT 2000.

**Text Books:**

**[1]** William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.
**[2]** Behrouz A. Frouzan: Cryptography and Network Security, Tata McGraw Hill.

**Reference Books:**

**[1]** Merkow, "Information Security Principles & Practices"
**[2]** Christof Paar & Jan Pelzel, Understanding Cryptography, Springer.
**[3]** Bare Act Information Technology ACT 2000.
**[4]** C K Shyamala, N Harini, Dr. T.R. Padmnabhan Cryptography and Security, Wiley.
**[5]** Bruce Schiener, "Applied Cryptography". John Wiley & Sons.
**[6]** Bernard Menezes," Network Security and Cryptography", Cengage Learning.
**[7]** Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill.
**[8]** Thomas R. Peltier, Justin Peltier, John Blackley, Information Security Fundamentals.

| **Basics of Theory of Computation** | | | |
|---|---|---|---|
| **Course Code:** | **BCA208** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2** | **Course Semester (U / P):** | **4U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. Understanding the basic concepts of theory of computation |
| 2. A general understanding of Regular Expressions |
| 3. Understanding of Context free Grammar (CFG) and Context Free Language (CFL) in Toc |
| 4. Understanding of Push down Automata in Toc |
| 5. Understanding of Turing Machine |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Understand basic concepts of Toc |
| 2. Understand the concept of regular expressions |
| 3. Understand the concept of CFG and CFL |
| 4. Understand the definition and description of Push down Automata |
| 5. Understand the concept of Turing Machine |

**UNIT I INTRODUCTION**

Introduction; alphabets, strings and languages; automata and grammars, deterministic finite automata (DFA)-formal definition, simplified notation: state transition graph, transition table, language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, language of NFA.

**UNIT II REGULAR EXPRESSIONS**

Regular expression (RE), definition, operators of regular expression and their precedence, algebraic laws for regular expressions, pumping lemma for regular languages. application of pumping lemma, closure properties of regular languages, decision properties of regular languages, FA with output: moore and mealy machine

**UNIT III CFG**

Context Free Grammar (CFG) and Context Free Languages (CFL): definition, examples, derivation, derivation trees, ambiguity in grammar, inherent ambiguity, ambiguous to unambiguous CFG, useless symbols, simplification of CFGs, normal forms for CFGs: CNF and GNF, closure properties of CFLs.

**UNIT IV PUSH DOWN AUTOMATA**

Push Down Automata (PDA): description and definition, instantaneous description, language of PDA, acceptance by final state, acceptance by empty stack, deterministic PDA, equivalence of PDA and CFG.

**UNIT V TURING MACHINES (TM)**

Basic model, definition and representation, instantaneous description, language acceptance by TM, variants of turing machine, TM as computer of integer functions, universal TM, halting problem, introduction to undecidability, undecidable problems about TMs.

**References Books:**

1. Hopcroft, Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education
2. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science : Automata, Languages and Computation”, PHI
3. Martin J. C., “Introduction to Languages and Theory of Computations”, TMH
4. Papadimitrou, C. and Lewis, C.L., “Elements of the Theory of Computation”, PHI

| | | | |
|---|---|---|---|
| **Introduction of Soft Computing** | | | |
| **Course Code:** | **BCA212** | **Course Credits:** | **2** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **4U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **02 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **30 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| **1.** The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing |
| 2. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. |
| 3. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective |
| **4.** Provide the mathematical background for carrying out the optimization associated with neural network learning |
| 5. Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project. |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1. Describe human intelligence and AI |
| 2. Explain how intelligent system works |
| 3. Apply basics of Fuzzy logic and neural networks.. |
| 4. Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience |
| 5. Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations |

**UNIT I INTRODUCTION TO SOFT COMPUTING**

Introduction to Soft Computing, Different soft computing Techniques: Fuzzy Logic, Artificial Neural Network ANN, Evolutionary computing. Applications of Soft computing.

**UNIT II FUZZY LOGIC**

Introduction to fuzzy logic, classical and fuzzy sets, overview of fuzzy sets, membership function, fuzzy rule generation, operations on fuzzy sets: compliment, intersection, union, combinations on operations.

**UNIT III ARTIFICIAL NEURAL NETWORK**

Artificial Neural Networks basic concepts: overview of biological neurons, computational neuron, mathematical model of neurons, ANN architecture, single layer and multilayer architectures.

**UNIT IV LEARNING FUNDAMENTALS**

Learning paradigms, supervised and unsupervised learning, reinforced learning, ANN training, algorithms perceptions, applications of artificial neural networks.

**UNIT V GENETIC ALGORITHMS**

Basic concepts, terminology of genetic algorithm, biological background,, working principles of genetic algorithms, fitness function.

**Text Books:**

1. Artificial Neural Networks: An introduction to ANN Theory and Practice, Peteus J. Braspenning, PHI publication, 2005.
2. Fuzzy Logic: A spectrum of Theoretical and Practical issues, Paul P. Wang, pearson publication 2004.

**Reference Books:**

1. Fuzzy Sets, Fuzzy logic, and Fuzzy Systems: Selected Papers- Lotfi Asker Zadeh, George J. Kilr, Bo yuan, 2005.
2. Foundations of Fuzzy logic and Soft Computing: 12th International Fuzzy conference proceeding, 2005
3. Neural Networks Theory, Particia Melin, Oxford University press, 2003
4. Neural Networks Theory and Application, Oscar Castillo, Wiley Eastern publication

| **Java Programming Lab** | | | |
|---|---|---|---|
| **Course Code:** | BCA282 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **2U** | **Course Semester (U / P):** | **4U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. To introduce students to java programming | | | |
| 2. To introduce the concepts of java to students | | | |
| 3. To familiarize students with steps of execution of java program | | | |
| 4. To familiarize students with different domains and application areas of java | | | |
| 5. To enable students in implementation of java programs of diverse problems | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1. Understand the java development kit environment and online compilers | | | |
| 2. Understand the significant concepts of data java | | | |
| 3. Understand the flow of data in java programming | | | |
| 4. Aware of application areas of java programming | | | |
| 5. Implement solutions of problems using java | | | |

1. Write a program in Java to create Class, Object.
2. Write a program in Java for illustrating various forms of inheritance.
3. Write a program in Java to read data from disk file.
4. Write a program in Java for illustrating Constructors

5. Write a program in Java for illustrating overloading
6. Write a program in Java for illustrating over riding
7. Write programs to create packages and multiple threads in Java.
8. Write a separate Java Code to implement each of the following:
    a. Visibility Controls: Private, Public and Protected
9. Write a separate Java Code to implement each of the following:
    a. Exception handling with Try, Catch, Throw, Throws, Finally
10. Write programs to create Applets.
11. Exception handling with Try, Catch, Throw, Throws, Finally Multiple catch statement with the following exceptions :

# SEMESTER V

| PHP | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA301** | **Course Credits:** | **3** |
| **Course Category:** | **CC21** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1 Knowledge of php, |
| 2 A general understanding of data types and a php page |
| 3 Understanding of web page form |
| 4 Understanding of sessions ,cookies |
| 5 Design a dynamic web page |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Learn the environment of Server Side Script. |
| 2. Learn the use of control structures and numerous native data types with their methods. |
| 3. create a form and Directories Understanding file & directory |
| 4. Make Database connectivity between Front End and Back End. |
| 5. Develop Dynamic Website that can interact with different kinds of Database Languages |

**UNIT 1:** Introduction to PHP Evaluation of PHP, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression. Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html.

**UNT 2:** Functions, Define a function, Call by value and Call by reference, Recursive function, String Creating and accessing, String Searching & Replacing String, Formatting String, String Related Library function, Array Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Some useful Library function.

**UNIT 3:** Handling HTML Form with Php Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission, Working with file and Directories Understanding file & directory, Opening and closing, a file, Coping, renaming and deleting a file, working with directories, Creating and deleting folder, File Uploading & Downloading.

**UNIT 4:** Session and Cookie Introduction to Session Control, Session Functionality, What is a Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session.

**UNIT 5:** Database Connectivity with MySql Introduction to RDBMS, Connection with MySql

Database, Performing basic database operation(DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.), Exception Handling Understanding Exception and error, Try, catch, throw. Error tracking and debugging.

**Text & Reference Books:**

1. Learning PHP, MySQL, books by ‘ O’ riley Press
2. Teach Yourself PHP in 24 Hours, Edition**:** 3rd, Matt Zandstra, Publisher: Sams Publishing, Copyright 2004 **ISBN**: 0-672-32619-1

| INTRODUCTION TO COMPILER DESIGN | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA303** | **Course Credits:** | **3** |
| **Course Category:** | **CC22** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1To learn the process of translating a modern high-level language to executable code. |
| 2 To develop an awareness of the function and complexity of modern compilers. |
| 3 To apply the code generation algorithms to get the machine code for the optimized |
| 4 To represent the target code in any one of the code formats |
| 5 To apply the optimization techniques to have a better code for code generation |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1 Understand the major phases of compilation and to understand the knowledge of Lex tool & YAAC tool |
| 2 Develop the parsers and experiment the knowledge of different parsers design without automated tools |
| 3 Construct the intermediate code representations and generation |
| 4 Convert source code for a novel language into machine code for a novel computer |
| 5 Apply for various optimization techniques for dataflow analysis |

**UNIT I INTRODUCTION TO COMPILER**

Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

**UNIT II PARSING TECHNIQUE**

Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, and preprocessing steps required for predictive parsing. Bottom up parsing: Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing, handling ambiguous grammar.

**UNIT III SYNTAX-DIRECTED TRANSLATION**

Semantic analysis : Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker. Symbol Tables: Symbol table format, organization for block structures languages, hashing, tree structures

representation of scope information. Block structures and non-block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays.

**UNIT IV SYMBOL TABLES**

Code optimization: Consideration for Optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation. Data flow analysis: Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation.

**UNIT V CODE GENERATION**

Object code generation: Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms, DAG for register allocation.

**Text Books:**

1. AlfredAho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson Education Asia, 2003.

**Reference Books:**

1. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
2. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
3. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003.
4. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
5. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

| **Basics of Computer Graphics** | | | |
|---|---|---|---|
| **Course Code** | **BCA305** | **Course Credit** | **03** |
| **Course Category** | **CC23** | **Course(U/P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No of Lectures + Tutorials(Hrs./Week)** | **03+00** | **Mid Semester Exam Hours:** | **01** |
| **Total no of Lectures(L+T)** | **45+00** | **End Term Exam Hours:** | **03** |
| **COURSE OBJECTIVES** | | | |
| **1.** The course introduces the basic concepts of computer graphics. | | | |
| **2.** The course provides the necessary theoretical background of computer graphics. | | | |

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|---|
| **3.** The course allows the students to develop programming skills in computer graphics through programming assignments. |
| **4.** The course provides the background of Image transformation in 2D |
| **5.** The course provides the theoretical background of 2D/3D images transformation |
| |
| **Course Outcomes** |
| At the end of the course the student should be able to understand the : |
| **1.** Basics knowledge of computer graphics |
| **2.** Understand the different graphics system and applications. |
| **3.** Understand the various algorithms for scan conversion and filling of basic objects and their comparative analysis. |
| **4.** Use of geometric transformations on graphics objects and their applications in composite forms. |
| **5.** Explore rendered projected objects to naturalize the scene in 2D view and use of illumination model for this. |

**UNIT - I Graphics Primitives:** Introduction to computer graphics, Basics of Graphics systems, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster scan systems, random scan systems, graphics monitors and workstations and input devices.

**UNIT - II Output Primitives:** Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood- fill algorithms. 2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

**UNIT III 2-D Viewing:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

**UNIT - IV 3-D Object Representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon-rendering methods.

**UNIT - V 3-D Geometric Transformations:** Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

**Text & Reference Books:**

1. Donald Hearn and M. Pauline Baker: Computer Graphics, PHI Publications.
2. Plastock: Theory & Problem of Computer Gaphics, Schaum Series.

3. Foley & Van Dam: Fundamentals of Interactive Computer Graphics, Addison Wesley.
4. Newman: Principles of Interactive Computer Graphics, McGraw Hill.
5. Tosijasu, L.K.: Computer Graphics, Springer-Verleg.

| **COMPUTER NETWORKS FUNDAMENTALS** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA 307** | **Course Credits:** | **3** |
| **Course Category:** | **CC24** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. Understanding of computer networks and its components |
| 2. A general understanding of switching and OSI layers |
| 3. Understanding of concept of congestion in the network |
| 4. Understanding of protocols used in computer networks |
| 5. Understanding of addressing in the computer network |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Understand network scenario |
| 2. Understand OSI and TCP/IP layers |
| 3. Understand the concept of congestion in the network |
| 4. Understand various protocols used in each layer |
| 5. Able to create network with the use of IP address |

**UNIT - I INTRODUCTION:** Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection oriented network - X.25, frame relay. THE PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.

**UNIT - II THE DATA LINK LAYER:** Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

**UNIT - III THE NETWORK LAYER:** Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.

**UNIT – IV THE TRANSPORT LAYER:** Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.

**UNIT - V THE APPLICATION LAYER:** Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

**TEXT BOOKS:**

1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.

**REFERENCE BOOKS:**

2. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
3. Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India

| **FUNDAMENTAL OF CYBER SECURITY** | | | |
|---|---|---|---|
| **Course Code:** | **BCA 315** | **Course Credits:** | **3** |
| **Course Category:** | **E1** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| **COURSE OBJECTIVES** | | | |
| 1 Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer | | | |
| 2 Practice with an expertise in academics to design and implement security solutions | | | |
| 3 Understand key terms and concepts in Cryptography, Governance and Compliance | | | |
| 4 Develop cyber security strategies and policies | | | |
| 5 Understand principles of web security and to guarantee a secure network by monitoring | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1 Analyze and evaluate the cyber security needs of an organization. | | | |
| 2 Measure the performance and troubleshoot cyber security systems | | | |
| 3 Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics | | | |
| 4 Design and develop a security architecture for an organization | | | |
| 5 Design operational and strategic cyber security strategies and policies. | | | |

**UNIT-I–Introduction to Cyber Security**

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a

Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

**UNIT-II–Cyber Security Vulnerabilities**

Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards-Overview, Access control, Cryptography, Deception, Denial of Service Filters, Ethical Hacking,

**UNIT-III–Cyberspace and the Law**

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

**UNIT-IV–Cyber Forensics**

Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access.

**UNIT-V– Securing Web Application, Services and Server**

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

**Reference Books:**

1. Jon Friedman. Mark Bouchard, CISSP. Foreword by John P. Watters, Cyber Threat Intelligence, Definitive Guide TM, 2015.
2. Scott J. Roberts, Rebekah Brown, Intelligence- Driven Incident Response: Outwitting the Adversary, O'Reilly Media, 2017.
3. Henry Dalziel, How to Define and Build an Effective Cyber Threat Intelligence Capability Elsevier Science & Technology, 2014.
4. John Robertson, Ahmad Diab, Ericsson Marin, Eric Nunes, VivinPaliath, Jana Shakarian, Paulo Shakarian, DarkWeb Cyber Threat Intelligence Mining Cambridge University Press, 2017.
5. Bob Gourley, The Cyber Threat, Createspace Independent Pub, 2014.

| **INTRODUCTION TO MULTIMEDIA SYSTEM** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA319** | **Course Credits:** | **3** |
| **Course Category:** | **E2** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **3+00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45+00** | **End Sem. Exam Hours:** | **3** |

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|---|
| **COURSE OBJECTIVES** |
| 1. This course aims to introduce the fundamental elements of multimedia. |
| 2. The emphasis will be on learning the representations, perceptions and applications of multimedia. |
| 3. On completion of the subject, the students will understand the technologies behind multimedia applications. |
| 4. It will provide an understanding of the fundamental elements in multimedia. |
| 5. Students will work with all aspects of images, sound, and Video. |
| |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1. Summarize the key concepts in current multimedia technology. |
| **2.** Create quality multimedia software titles. |
| 3. Know about how the text, sound, images, and video get digitized. |
| 4. Able to add multimedia data to their projects. |

**Unit 1**. Introduction to Multimedia, What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media. Computer Fonts and Hypertext, Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap font International character sets and hypertext.

**Unit 2** Audio fundamentals and representations, Digital Audio, Digitization of sound, frequency and bandwidth, data rate, audio file format, Sound synthesis, MIDI Audio, MIDI vs Digital Audio, Audio Recording, Voice Recognition & Response, Compression and transmission of audio on Internet, Audio software and hardware with real-world applications.

**Unit 3** Image fundamentals and representations, Colour Science , Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.

**Unit 4**. Video and Animation, Video Basics , How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.

**Unit 5.** Multimedia Authoring, Multimedia Authoring Basics, Some Authoring Tools, Macromedia Director & Flash.

**Text Books/Reference Books**

1. Multimedia: Sound & Video, Lozano, 1997, PHI, (Que)
2. Multimedia: Production, planning and delivery, Villamil & Molina, Que, 1997

3. Multimedia on the PC, Sinclair, BPB
4. Multimedia: Making it work, Tay Vaughan, fifth edition, 1994, TMH.
5. Multimedia in Practice by Jeff coate Judith, 1995, PHI.

| PHP LAB | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA381** | **Course Credits:** | **3** |
| **Course Category:** | **CC-L** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. Introduction to the open source Web scripting language PHP. | | | |
| 2. Build dynamic Web applications. Semantics and syntax of the PHP language, including discussion on the practical problems that PHP solves | | | |
| 3. Write server-side cross-platform HTML-embedded scripts to implement dynamic Web pages that interact with databases and files. | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1. Write PHP scripts to handle HTML forms. | | | |
| 2. Write regular expressions including modifiers, operators, and metacharacters. | | | |
| 3. Create PHP programs that use various PHP library functions, and that manipulate files and directories | | | |
| 4. Analyze and solve various database tasks using the PHP language | | | |
| 5. Analyze and solve common Web application tasks by writing PHP programs | | | |

**NOTE: Suggested list of experiments but not limited to these only.**

**List of Experiments:**

1. Study of web Standards & Web Based Architecture
2. Study of Basic Computer Languages & Design Student Sign-UP Form Using HTML, JavaScript, HTML5 & CSS
3. Introduction To PHP programming, XAMPP Tool and Dreamweaver Editor
4. Write a Simple Hello Program in PHP by Installing & Configuring XAMPP with Dreamweaver

5. Study Of Basic Building Blocks In PHP & Write a Program in PHP for type casting of a Variable.
6. Study Of Control Structure & Loops in PHP & write a program in PHP to display multiplication table using Nested For Loop
7. Study Of Array and Function in PHP & Write a program In PHP to Sort an array using function (Bubble Sort)
8. Study Of Form handling In PHP & Design a personal Information form, then Submit & Retrieve the Form Data Using $_GET(), $_POST() and $_REQUEST() Variables
9. Study Of Server Side Validation and Page Redirection in PHP & design A login form and validate that form using PHP programming
10. Write a program for image uploading in a form and display image in PHP.
11. Study Of Cookies And Sessions In PHP Create Admin Login, Logout form using session variables
12. Study Of MYSQL DDL, DML, DCL Commands Installation Of MYSQL 5.5 On windows and Executes their basic Commands
13. Study Of PHP Data Base Connectivity with MYSQL. Write a PHP Code to make database connection, Create Data Base, create table in Mysql and Operations Insert, Delete, Update, Select the Data From Data Base.

| **INTRODUCTION TO COMPILER DESIGN LAB** | | | |
|---|---|---|---|
| | | | |
| **Course Code:** | **BCA383** | **Course Credits:** | **2** |
| **Course Category:** | **CC-L** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **NO** |
| **Total No. of Lectures (L + T):** | **10 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1To realize basics of compiler design and apply for real time applications | | | |
| 2 To introduce different translation languages | | | |
| 3 To know about compiler generation tools and techniques | | | |
| 4 To learn working of compiler and non-compiler applications | | | |
| 5 Design a compiler for a simple programming language | | | |
| | | | |
| **COURSE OUTCOMES** | | | |

| At the end of the course the students should be able to: |
|---|
| 1 Understand the major phases of compilation and to understand the knowledge of Lex tool & YAAC tool |
| 2 Able to write the code by using YACC and lex. |
| 3 understand the different types of parsing techniques and should be in a position to solve the problem. |
| 4 Convert source code for a novel language into machine code for a novel computer |
| 5 Apply for various optimization techniques for dataflow analysis |

**NOTE: Suggested list of experiments but not limited to these only.**

**List of Experiments:**

1. Define LEX and YACC tools in detail.
2. Write a program to check whether a string belongs to the grammar or not.
3. Write a program to generate a parse tree.
4. WAP to convert regular expression into NFA.
5. WAP to generate tokens for a given grammar.
6. Write a program to find leading terminals.
7. Write a program to find trailing terminals.
8. Write a program to compute FIRST of non-terminals.
9. Write a program to compute FOLLOW of non-terminals.
10. Write a program to check whether a grammar is left recursive and remove left recursion.
11. Write a program to remove left factoring.
12. Write a program to check whether a grammar is Operator precedent.
13. Write a Program to implement Push Down Automata.
14. Write a program to implement Thomson’s construct

# SEMESTER VI

| .NET Technology | | | |
|---|---|---|---|
| **Course Code:** | **BCA 302** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

**COURSE OBJECTIVES**

1. Introduction to the .NET framework
2. Building multi-tier enterprise applications.
3. ASP.NET Web services and web service security
4. Client/Server Programming, 3-tier architecture.
5. Simple Object Access Protocol (SOAP) and Web Services.

**COURSE OUTCOMES**

At the end of the course the students should be able to:

1. Understand the development and deployment cycles of enterprise applications
2. Utilize the .NET framework to build distributed enterprise applications.
3. Develop ASP.NET Web Services, secure web services, and .NET remoting applications.
4. Understand the 3-tier software architecture (presentation/client tier, application tier, data tier) and develop multi-tier applications
5. Develop web applications using a combination of client-side (JavaScript, HTML, XML, WML) and server-side technologies (ASP.NET, ADO.NET).

**UNIT I: Introduction to .Net Framework:**
Introduction to .NET: The origin of .NET, Basics of .Net Framework & its Key design goals, 3-tier architecture, managed code, assemblies, CLR, Execution of assemblies code, IL, JIT, .NET framework class library, common type system, common language specification, metadata; Interoperability with unmanaged code. Net Framework Base Classes: System Namespaces; the System Types; System. object class; System. Exception Class; System. Collections.

**UNIT II: Understanding the Development Environment:**
.NET Integrated Development Environment: Projects & Solutions, User Interface Elements, The Visual Studio Start Page; Visual Studio.Net work area; Navigational Features, Understanding Window Forms; Viewing and changing properties; Adding controls to the form. Designing Visual Components: Using the task list.

**UNIT III: Introduction to VB .Net:**
Data Types, Operators, Methods, Handling Strings, Jagged Array, Array list, Indexer (one Dimension) and property, Interfaces, Constructors, Destructors.
User Interface: Procedures in VB.NET, Garbage Collection, Message boxes; Dialog boxes; Menus and Toolbars.

**UNIT IV: Working with Database:**
Architecture of ADO.Net, Comparison with ADO, ADO.Net Object Model, Net Data provider, Data Adapter, Data Set, Data Row, Data Column, Data Relation, command, Data Reader, Connecting to

Database, Accessing & Manipulating Data and Performing Data Updates. Text Books/ Reference

**Books**:

1. Jeffrey Richter, Francesco Balena : Applied .Net Framework.
2. Prog. In MS VB. Net, TMH Publications.
3. Michael Halvorsan : Microsoft Visual Basic.NET step by step,PHI Publication.
4. Rebecca M.Riordan: Microsoft ADO.NET Step By Step , PHI Publication. Note: Latest and additional good books may be suggested and added from time to time

| **Basics of Internet of Things** | | | |
|---|---|---|---|
| **Course Code:** | BCA304 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1. To Understand what IoT is and how it works | | | |
| 2. Recognize the factors that contributed to the emergence of IoT | | | |
| 3. Understand the Design and program IoT devices | | | |
| 4. Use of real IoT protocols for communication | | | |
| 5. Understand how to Transfer IoT data to the cloud and in between cloud providers | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 6. Understanding the IoT | | | |
| 7. Understanding the concept of IoT Design | | | |
| 8. Understanding of IoT Protocols | | | |
| 9. Understanding of IoT infrastructure | | | |
| 10. Able to understand building blocks of Internet of Things and characteristics. | | | |

**UNIT I: INTRODUCTION**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.

**UNIT II: IOT PROTOCOLS**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

**UNIT III: WEB OF THINGS**

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and

Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

**UNIT IV: INTEGRATED**

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon

**UNIT V: APPLICATIONS**

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging

**Text Books**

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).

**Reference Books**

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications

| **.NET Technology Lab** | | | |
|---|---|---|---|
| **Course Code:** | BCA382 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | |
| **Total No. of Lectures (L + T):** | **10** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. The student will use Visual Basic.Net to build Windows applications using structured and object-based programming techniques. |
| 2. Students will be exposed to the following concepts and skills |
| 3. Design/develop programs with GUI interfaces |
| 4. Code programs and develop interface using Visual Basic .Net |
| 5. Perform tests, resolve defects and revise existing code |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic |
| 2. Students will describe the basic structure of a Visual Basic.NET |
| 3. Students will create applications using Microsoft Windows Forms |
| 4. Students will create applications that use ADO. NET |
| 5. project and use main features of the integrated development environment (IDE) |

1. Program to display the addition, subtraction, multiplication and division of two number using console application.

0. Program to display the first 10 natural numbers and their sum using console application.

0. Program to display the addition using the windows application.

0. Write a program to convert input string from lower to upper and upper to lower case.

0. Write a program to simple calculator using windows application.

0. Write a program working with Page using ASP.Net.

0. Write a program working with forms using ASP.NET.

0. Write a program to connectivity with Oracle database.

0. Write a program to access data source through ADO.NET.

0. Write a program to manage the session.

| **Internet of Things Lab** | | | |
|---|---|---|---|
| **Course Code:** | BCA384 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1. To develop basic Programming Skills |
| 2. To develop Graphical Programming |
| 3. To learn Hardware Interfacing |
| 4. To Debugging Techniques |
| 5. To design and develop Android App for Smart Home Automation |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1. Able to demonstrate various sensor interfacing using Visual Programming Language |
| 2. Able to analyze various Physical Computing Techniques. |
| 3. Able to demonstrate Wireless Control of Remote Devices. |
| 4. Able to design and develop Mobile Application |
| 5. Interact with Sensors and Actuators. |

1. LED Blink and Pattern

0. Segment Display

0. Push Button

0. LED Pattern with Push Button Control
0. Push Button Counter
0. LM35 Temperature Sensor
0. Push Button Counter
0. Analog Inputs
0. Analog Input & Digital Output
0. IR Sensor Analog Input

## Electives

| Basics of Blockchain | | | |
|---|---|---|---|
| **Course Code:** | BCA310 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 6. To introduce the concept of blockchains |
| 7. To understand the mechanism and working of Blockchains in existing applications. |
| 8. To understand the cryptographic advantages of blockchains in financial, medical and other domains. |
| 9. Understanding Ethereum blockchain technology and its applications and working knowledge of smart contracts. |
| 10. Understanding varied applications of blockchains, its implementations and how it is pushing the frontiers of technology in all domains. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 11. Understand the idea behind Blockchain technology. |
| 12. Understand the cryptographic advantages of blockchains over previously existing systems in finance, medicine and other domains. |
| 13. Understand cryptocurrency (and bitcoins), its usage, and the concepts associated with it. |
| 14. Have a working knowledge of Ethereum blockchain Technology and its implementation in smart contracts. |
| 15. Analyze the advantages of blockchains in various applications and use it to their advantage. |

**Unit 1: Introduction of Cryptography and Blockchain:**
What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

**Unit 2: Bitcoin and Cryptocurrency:** What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain And Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency.

**Unit 3: Introduction to Ethereum:**
What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction, Smart Contracts, Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer.

**Unit 4: Solidity Programming:**
Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real,

String, Bytes, Arrays, Mapping, Enum, address)

**Unit 5: Blockchain Applications:**
Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins

**References**:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Antonopoulos, Mastering Bitcoin.
3. Antonopoulos and G. Wood, Mastering Ethereum.

| **Basics of Data Science** | | | |
|---|---|---|---|
| **Course Code:** | BCA318 | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **6U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 11. To introduce students to data science | | | |
| 12. To introduce the concepts of data science to students | | | |
| 13. To familiarize students with flow of data science projects | | | |
| 14. To familiarize students with different domains and application areas of data science | | | |
| 15. To enable students in implementation of data science projects | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 16. To understand the data science evolution | | | |
| 17. To understand the significant concepts of data science | | | |
| 18. To understand the flow of data science projects | | | |
| 19. To aware of applications areas of data science | | | |
| 20. Implement data science projects | | | |

**Unit – I: Introduction**
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

**Unit – II:**
Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

**Unit – III:**
Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

**Unit – IV:**
Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample

Evaluation – Prediction and Decision Making.

**Unit – V:**
Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

**REFERENCES**:

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

| **Computer Vision** | | | |
|---|---|---|---|
| **Course Code:** | **BCA 316** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **4U** | **Course Semester (U / P):** | **7U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| **COURSE OBJECTIVES** | | | |
| 1 Understand Camera model , Image formation in CV | | | |
| 2 To understand different filter and features | | | |
| 3 Understanding clustering , grouping and model fitting | | | |
| 4 To understand register different objects | | | |
| 5 Understand computer vision using machine learning | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1 How the camera model works and different color shading | | | |
| 2 Apply different filter and features | | | |
| 3 To do application of clustering , grouping and model fitting | | | |
| 4 Apply registering rigid and deformable objects | | | |
| 5 Apply Computer Vision in Machine learning | | | |

**Unit 1: Introduction :**

Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality

**Unit 2: Image Formation Models :**

Monocular imaging system , Radiosity: The ‘Physics’ of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images

Unit 3: Image Processing and Feature Extraction:
Image preprocessing, Image representations (continuous and discrete) , Edge detection, Motion Estimation : Regularization theory , Optical computation , Stereo Vision , Motion estimation , Structure from motion

**Unit 4: Shape Representation and Segmentation :**
Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multiresolution analysis.

**Unit 5: Object recognition :**
Hough transforms and other simple object recognition methods, Shape correspondence and shape matching , Principal component analysis , Shape priors for recognition, Image Understanding : Pattern recognition methods, HMM, GMM and EM

**Unit 6: Applications:**
Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

**Reference Books:**
1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
3.R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
4. D H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
5.Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
7. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
8. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
9. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

| Introduction to WIRELESS Technology | | | |
|---|---|---|---|
| **Course Code:** | **BCA 312** | **Course Credits:** | **3** |
| **Course Category:** | **CC** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **5U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1Enable students to acquire in-depth knowledge in the field of wireless communication technology with an ability to integrate existing and new knowledge with the advancement of the technology. |
| 2.Develop students to critically analyze the problems in the field of wireless communication technology and find optimal solution. |
| 3.Train students to conduct research and experiments by applying appropriate techniques and tools with an understanding of the limitations for sustainable development of society. |
| 4.Prepare students to act as a member and leader of the team to contribute positively to manage projects efficiently in the field of wireless communication technology. |
| 5.Train students to effectively communicate, write reports, create documentation and make presentations by adhering to appropriate standards. |
| **COURSE OUTCOMES** |
| At the end of the course the students should be able to: |
| 1. Independently carry out research /investigation and development work to solve practical problems. |
| 2. Write and present a substantial technical report/document. |
| 3.Degree of mastery in wireless communication technology at a level higher than the requirements in the appropriate bachelor program. |
| 4.Create, select and apply appropriate techniques and tools to undertake activities in the field of wireless communication technology with an understanding of the limitations. |
| 5.Manage wireless communication methodologies. |

**UNIT I INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM**

An overview of wireless communication and future vision. Wireless communication system and standards: satellite communication system, GPS, paging system, cordless phone, wireless local loop, RFID.

**Unit II: The cellular fundamentals:**

cellular communication and frequency reuse, general architecture of a cellular system, channel assignment strategies, hand-off in a cellular system. Interference and cellular system capacity: co-channel interference and adjacent channel interference, power control, evolution of mobile cellular communication: different generations of mobile cellular communication (1G, 2G. 2.5G, 3G and beyond), typical cellular standards (AMPS, GSM, GPRS, WCDMA, LTE, concept of LTE-advanced), 4G features and challenges, 5G vision.

**Unit III: Signal propagation in mobile communication :**
mobile cellular environment, multipath propagation and fading, free space propagation model, propagation path loss, outdoor propagation models (Okumura model & Hata model), indoor propagation models, power delay profile, channel parameters (delay spread, doppler spread, coherence bandwidth, coherence time, LCR and ADF). (8)

**Unit IV: Wireless Communication Networks :** Wireless Personal Area Networks (Bluetooth, UWB and ZigBee), Wireless Local Area Networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), Wireless Metropolitan Area Networks (WiMAX), Ad-hoc Wireless Networks.

**Unit V: Multiple access schemes:** duplexing schemes, FDMA, TDMA, SDMA, spread spectrum technique and CDMA, OFDMA, ALOHA and CSMA.

Text Books:
1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
2. Sanjay Kumar, “Wireless Communication the Fundamental and Advanced Concepts” River Publishers, Denmark, 2015 (Indian reprint). Reference Books: 1. Vijay K Garg, “Wireless Communications and Networks”, Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint) 2. J. Schiller, “Mobile Communication” 2/e, Pearson Education, 2012.
3. Iti Saha Misra, “Wireless Communication and Networks : 3G and Beyond”, 2/e, McGraw Hill Education (india) Private Ltd, New Delhi, 2013.

| **CLOUD COMPUTING** | | | |
|---|---|---|---|
| **Course Code:** | **BCA 319** | **Course Credits:** | **3** |
| **Course Category:** | **E5/DSE** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **4U** | **Course Semester (U / P):** | **7U** |
| **No. of Lectures + Tutorials (Hrs/Week):** | **03 + 00** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45 + 00** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1.Comprehensive and in-depth knowledge of Cloud Computing concepts, | | | |
| 2.Understand the technologies, architecture and applications | | | |
| 3.Cloud Computing fundamental issues, technologies, applications and implementations. | | | |
| 4. Expose the students to frontier areas of Cloud Computing and information systems | | | |
| 5. Providing sufficient foundations to enable further study and research. | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1.Define the fundamental principles of distributed computing | | | |
| 2.Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing | | | |
| 3.Analyze the performance of Cloud Computing. | | | |
| 4.Understand the concept of Cloud Security. | | | |

5.Learn the Concept of Cloud Infrastructure Model.

**Unit 1: Introduction to Cloud Computing**:

Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2,Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing

**Unit 2: Introduction to Cloud Technologies:**
Study of Hypervisors Compare SOAP and REST Web Services, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization Multi Tenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications

**Unit 3: Data in the cloud**:
Map-Reduce model Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud Cloud computing security architecture:Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security.

**Unit 4: Cloud computing security challenges**:
Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability.

**Unit 5: Cloud computing platforms**

Cloud computing platforms, Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform

**Text Books:**

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, Cloud Computing for Dummies by (Wiley India Edition)
2. Gautam Shroff, Enterprise Cloud Computing by, Cambridge
3. Ronald Krutz and Russell Dean Vines, Cloud Security by, Wiley-India

| | | | |
|---|---|---|---|
| **Information Security** | | | |
| **Course Code:** | **BCA 321** | **Course Credits:** | **4** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1: To develops fundamental understanding of data, information and the security requirements. |
| 2: To create awareness about information security vulnerabilities, threats, principles, assets and risk management. |
| 3: To learn and understand encryption algorithms and related cryptographic operations. |
| 4: To develop the ability to understand entity authentication requirements in networks and web security protocols and applications |
| 5: To Acquire understanding of information security related policies, violations, cybercrimes, laws and standards. |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1: Understand the information and the security requirements fundamentals. |
| 2: Understand the security principles and risk management procedure. |
| 3: Understand the cryptographic algorithms with their applications. |
| 4: Understand network and web security protocols and malicious codes, firewalls etc. |
| 5: Understand the requirement of policies, standards, cyber security crimes and laws. |

**UNIT I INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM**

Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks , Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks

**UNIT II MOBILE RADIO PROPAGATION MODEL, SMALL SCALE FADING AND DIVERSITY**

Large scale path loss:-Free Space Propagation loss equation, Pathloss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale.

**UNIT III MULTIPLE ACCESS TECHNIQUES**

Introduction, Comparisons of multiple Access Strategies TDMA,CDMA, FDMA, OFDM , CSMA Protocols. Multiple access for radio pocket system: Pure ALOHA, slotted ALOHA, CSMA and their version : Packet and polling reservation Based multiple access schemes

**UNIT IV WIRELESS SYSTEMS**

GSM system architecture, Radio interface, Protocols, Localization and calling, Handover,

Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system, Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.

**UNIT V RECENT TRENDS**

Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.

**Text Books:**

1. Wireless Communication, Theodore S. Rappaport, Prentice hall
2. Wireless Communications and Networking,Vijay Garg, Elsevier
3. Wireless digital communication, Kamilo Feher, PHI
4. 4 Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
5. 5 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
6. 6 Wireless Communications-T.L.Singh-TMH

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|---|---|---|---|
| **Computer Network Security** | | | |
| **Course Code:** | **BCA 306** | **Course Credits:** | **4** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1: To develops fundamental understanding of data, information and the security requirements. | | | |
| 2: To understand basics of Cryptography and Network Security. | | | |
| 3: . To be able to secure a message over insecure channel by various means. | | | |
| 4: To learn about how to maintain the Confidentiality, Integrity and Availability of a data. | | | |
| 5: To understand various protocols for network security to protect against the threats in the networks. | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1: Understand the information and the security requirements fundamentals. Analyze and design classical encryption techniques and block ciphers. | | | |
| 2. Understand and analyze data encryption standard. | | | |
| 3 Understand and analyze public-key cryptography, RSA and other public-key cryptosystems | | | |
| 4: Understand network and web security protocols and malicious codes, firewalls etc. such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc. | | | |
| 5: Understand key management and distribution schemes and design User Authentication | | | |

**UNIT - I SECURITY FUNDAMENTALS**
Introduction, Terminology, Attacks, Security Goals : Authentication, Authorization, Cipher Techniques: Substitution and Transposition, One Time Pad, Modular Arithmetic, GCD, Euclid's Algorithms, Chinese Remainder Theorem, Discrete Logarithm, Fermat Theorem, Block Ciphers, Stream Ciphers. Secret Splitting and Sharing.

**UNIT - II CRYPTOGRAPHY**
Symmetric Key Algorithms: DES, AES, BLOWFISH, Attacks on DES, Modes of Operations, Linear Cryptanalysis and Differential Cryptanalysis, Public Key Algorithms: RSA, Key Generation and Usage.

**UNIT - III MESSAGE DIGEST AND KEY MANAGEMENT**
Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, PKI. Diffie-Hellman Key Exchange. One Way Authentication, Mutual Authentication, Kerberos 5.0.

**UNIT IV NETWORK SECURITY**
Layer Wise Security Concerns, IPSEC- Introduction, AH and ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol. Intrusion Detection Systems: Introduction, Anomaly Based, Signature Based, Host Based, Network Based Systems.

**UNIT - V INTRODUCTION TO CYBER SECURITY**
Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyberstalking, Cloud Computing and Cybercrime

**UNIT – VI TOOLS AND METHODS USED IN CYBERCRIME**
Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber lawsIndian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures.

**Text Books**
**1**. BruiceSchneier, "Applied Cryptography- Protocols, Algorithms and Source code in C", 2nd Edition, Wiely India Pvt Ltd, ISBN 978-81-265-1368-0
**2**. Nina Godbole, SunitBelapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiely India Pvt.Ltd.,ISBN- 978-81-265-2179-1
**3**. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, ISBN-978-81-315-1349-1
Reference Books
**4**. Nina Godbole, " Information Systems Security", Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
**5**. Willaim Stallings, "Computer Security : Principles and Practices", Pearson Ed. ISBN :978-81-317-3351-6
**6**. Mark Merkow, " Information Security-Principles and Practices", Pearson Ed. 978-81-317-1288- 7
**7**. CK Shyamala et el., "Cryptography and Security", Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9
**8**. Berouz Forouzan, "Cryptography and Network Security", 2 edition, TMH, ISBN :9780070702080

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|---|---|---|---|
| **Fundamental of Digital Image Processing** | | | |
| **Course Code:** | **BCA 320** | **Course Credits:** | **4** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1: To study the image fundamentals and mathematical transforms necessary for image processing. |
| 2: To study the image enhancement techniques |
| 3: To study image restoration procedures. |
| 4: To study the image compression procedures |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1: understand the need for image transforms different types of image transforms and their properties. |
| 2. develop any image processing application. |
| 3 understand the rapid advances in Machine vision. |
| 4: learn different techniques employed for the enhancement of images.. |
| 5: learn different causes for image degradation and overview of image restoration techniques. |

**Unit I:** Review of Signals and Systems, Sampling and data reconstruction processes, Z transforms. Chirp Z Algorithm, Goertzel's Algorithm, Discrete linear systems, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters,IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures.

**Unit II: DSP Transforms:**
Fourier transform, Discrete sine and cosine transform, Discrete Hartely transform, short time Fourier transform, wavelet transform, Hilbert transform, Hilbert-Huang transform, Stockwell transform.

**Unit III:** Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Multi resolution signal analysis, wavelet decomposition, Applications in subband coding.

**Unit IV:** Linear prediction and Optimum Linear Filters: Random signals and power spectra, Forward and backward Linear prediction, solutions of the normal equations, AR lattice and ARMA lattice-ladder filters, Wiener filters.

**Unit V:** Power spectrum estimation: Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation.

Text Books
1. J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007. (T1)
2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
3. S. Haykin and T. Kailath, Adaptive Filter Theory, Pearson Education, 4th Edition, 2005.

Reference Books
1. Digital Signal Processing 3/E by S.K.Mitra TMH Edition.
2. Fundamentals of adaptive filtering, A. H. Sayed, Wiley, 2003.
3. Monson H. Hayes, Statistical Digital Signal Processing and Modelling, Wiley, 2002

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|---|---|---|---|
| **Concepts of Mobile Computing** | | | |
| **Course Code:** | **BCA 308** | **Course Credits:** | **4** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |
| | | | |
| **COURSE OBJECTIVES** | | | |
| 1: To make the student understand the concept of mobile computing paradigm, its novel applications and limitations. . | | | |
| 2: To understand the typical mobile networking infrastructure through a popular GSM protocol | | | |
| 3 To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer | | | |
| 4: To understand the ad hoc networks and related concepts. | | | |
| To understand the platforms and protocols used in mobile environment | | | |
| | | | |
| **COURSE OUTCOMES** | | | |
| At the end of the course the students should be able to: | | | |
| 1: Tounderstandconcepts ofMobile Communication. (Understand) | | | |
| 2. Toanalysenext generation Mobile Communication System. (Analyze). | | | |
| 3 To understand network and transport layers of Mobile Communication. (Understand). | | | |
| 4: Analyze various protocols of all layers for mobile and ad hoc wireless communication networks. (Analyze) | | | |
| 5: To understand IP and TCP layers of Mobile Communication. (Understand).. | | | |

**UNIT - I INTRODUCTION**

PCS Architecture, Cellular Telephony, Mobile Computing Architecture Mobile devices: Device Overview, Input mechanism, Wireless communication, Mobile Device classification, Device Manufacturers Mobile Generations: Devices and Applications for: 1G, 2G, 2.5G, 3G Mobility Management :Handoff, Roaming Management, Roaming Management under SS7 Handoff Management :Handoff Detection, Strategies for Handoff Detection, Channel Assignment, Link Transfer Types, Hard Handoff, Soft Handoff

**UNIT - II GSM AND MOBILITY MANAGEMENT**
GSM System Overview: GSM Architecture, Data Services, Unstructured Supplementary Service Data Mobility Management : GSM Location Update, Mobility Databases, Failure Restoration, VLR Identification Algorithm, VLR Overflow Control

**UNIT - III GSM SERVICES**
GSM Service: SMS Architecture, SMS Protocol Hierarchy, Mobile-Originated Messaging, Mobile – Terminated Messaging International Roaming for GSM: International GSM, Call Setup, Reducing the International Call Delivery Cost Mobile Number Portability: Fixed Network Number Portability, Number Portability for Mobile Networks, Mobile Number Portability Mechanisms, Implementation Costs for Mobile Number Mobile prepaid service: Wireless intelligent network approach, service node approach, hot billing approach, handset based approach

**UNIT - IV GSM DATA LAYER**
General Packet Radio Service (GPRS): GPRS Functional Groups, GPRS Architecture GPRS Network Nodes, GPRS Interfaces, GPRS Procedures, GPRS Billing, Evolving from GSM to GPRS Wireless Application Protocol (WAP): WAP Model, WAP Gateway, WAP Protocols WAP UAProf and Caching, Wireless Bearers for WAP, WAP Developer Toolkits, Mobile Station Application Execution Environment Third-Generation Mobile Services: Paradigm Shifts in Third-Generation Systems W-CDMA and cdma2000, Improvements on Core Network, Quality of Service in 3G Wireless Operating System for 3G Handset

**UNIT - V MOBILE APPLICATION ARCHITECTURES**
Choosing the right architecture: Application architecture, Device type, Enterprise connectivity, Enterprise data, Enterprise integration, User notification, security, battery life Application Architectures: Wireless internet, Smart Client, messaging Smart Client Overview: architecture Smart Client Development process: Need analysis phase, design phase, implementation and testing phase, deployment phase

**UNIT - VI RECENT AND FUTURE TRENDS**
Android OS and its Architecture, Mobile Applications, User Interface design for mobile Applications, Managing Application Data, Performance, Scalability, Modifiability, Availability and Security of Mobile Applications, Testing Methodologies for Mobile Applications. Future Mobile Generations: 4G, 5G

**Text Books**
1. Yi Bang Lin, “Wireless and Mobile Network Architectures”, Wiley Publications.
2. Martyn Mallick, “Mobile and Wireless design essentials”, Wiley Publications. Reference Books 1. Johen Schiller, “Mobile communications”, Pearson Publications.
3. Asoke Talukder and Roopa Yavagal”, Mobile Computing Technology, Applications and Service Creation”, Second Edition, ISBN-13: 978-0-07-014457-6, Tata McGraw Hill.
4. Iti Shah Mishra, “Wireless Communication and Networks 3G and Beyond”, Second Edition, ISBN-5. 978-1-25-906273-5, McGraw Hill Education
6. Theodore S. Rappaport, “Wireless Communications principles and practice”, 2nd edition, Pearson Education, ISBN – 978-81-317-3186-4.
7. Ke-Lin Du & M.N. S. Swamy, “Wirless Communication Systems, From RF Subsystems to 4G Enabling Technologies, ISBN: 978-0-521-18736-7, Cambridge University Press,

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|---|---|---|---|
| **Fundamentals of Optimization Techniques** | | | |
| **Course Code:** | **BCA 314** | **Course Credits:** | **4** |
| **Course Category:** | **C** | **Course (U / P)** | **U** |
| **Course Year (U / P):** | **3U** | **Course Semester (U / P):** | **3U** |
| **No. of Lectures + Tutorials (Hrs. /Week):** | **03** | **Mid Sem. Exam Hours:** | **1** |
| **Total No. of Lectures (L + T):** | **45** | **End Sem. Exam Hours:** | **3** |

| **COURSE OBJECTIVES** |
|---|
| 1: Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function). |
| 2: The problem formulation by using linear, dynamic programming, game theory and queuing models |
| 3 The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making. |
| 4: Formulation of mathematical models for quantitative analysis of managerial problems in industry |

| **COURSE OUTCOMES** |
|---|
| At the end of the course the students should be able to: |
| 1: Recall the theoretical foundations of various issues related to linear programming modeling to formulate real-world problems as a L P model |
| 2. Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function. |
| 3 Identify appropriate optimization method to solve complex problems involved in various industries |
| 4: Identify appropriate optimization method to solve complex problems involved in various industries |
| 5: Find the appropriate algorithm for allocation of resources to optimize the process of assignment. |

**Unit I INTRODUCTION**

Concept of optimization – classification of optimization – problems.

**UNIT II LINEAR PROGRAMMING**

Examples of linear programming problems – formulation simplex methods variable with upper bounds – principleduality -dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem – maximal two problem – L.P. representation of networks.

**UNIT III QUEUING THEORY**

Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues. Name of the instructor Class handling Office location Office phone Email (domain:@ bharathuniv.ac.in Consultation Dr.Krishnakumar Final year Civil Civil Block 9.00 - 9.50 AM Page 2 of 7

**UNIT IV UNCONSTRAINED OPTIMIZATION**

Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convegence – unibariate search – steepest and desent methods- metcher reeves method -conjugate gradient method.

**UNIT V CONSTRAINED OPTIMIZATION**

Necessary and sufficient condition – equality constraints, inequality constraints -kuhu – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of sibel directions.

**TEXT BOOK(S)**

1. Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979. REFERENCE BOOKS:
1. David G.Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.
2. Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964.
3. Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970.
4. HarndyA.Tahh. "operations Research, An Introduction", Macmillan Publishers Co.NewYork,1982.
5. Beightferand S. others, "Foundations of Optimization Pill", New Delhi, 1979.