# Program Curriculum

# Bachelor of Computer Applications Degree Program

**Program Code: OBC**

**Centre for Distance and Online Education**

# University's Vision, Mission, and Core Values

**Vision:** We visualize Graphic Era (Deemed to be University) as an internationally recognized, equity-driven, ethically engaged, diverse community whose members work collaboratively for positive transformation in the world, through leadership in teaching, research, and social action.

**Mission:** The mission of the university is to promote learning in true spirit and offering knowledge and skills in order to succeed as professionals. The university aims to distinguish itself as a diverse, socially responsible learning community with a high-quality scholarship and academic rigor

**Core Values:**
- Continuous learning and improvement
- Simplicity
- Integrity and trust
- Ethics

# Program Curriculum: Bachelor of Computer Applications

1. **Title of the Degree:** Bachelor of Computer Applications (BCA)

2. **Mode of Study:** Fully Online

3. **Program Curriculum will be Effective From:** The Academic Year 2023-2024

4. **Rationale for the Programme:**

Computers, computer networks, and mobile computing have catalyzed the disruption of digital evolution. In the recent past, fast-growing information and communication technology (ICT) is the backbone of strategic planning in most business houses, government organizations, and educational institutes globally. Organizations that seek to leverage the latest technologies and communication tools require expert professionals who can apply the principles of computer science and information technology to solve their problems effectively.

Graphic Era Deemed to be University's BCA is a three-year, six-semester, undergraduate programme. The program is designed to function as the runway from the university to the vast expanse of the professional career space. The curriculum of the BCA program is designed to meet the growing demand for qualified professionals in the field of ICT. It is designed to provide a potent blend of theoretical knowledge and practical skills in core ICT areas like database management, computer networks, data structures, and numerous programming languages. The curriculum also gives exposure to advanced topics such as cyber security and mobile application development. Further, it includes courses that prepare the student in financial accounting and professional skills paving the way for career success in the field of computer applications.

Career opportunities for BCA graduates are infinite. The program enables the graduates to pursue multi-faceted, lucrative, global careers as system analysts, system managers, project managers, database administrators, system designers, applications developers, and programmers in corporate houses, government organizations, and educational institutes.

5. **Program Educational Objectives (PEOs)**

The objectives of the BCA Programme are to:

**PEO-1.** To produce students employable towards building a successful career based on a sound understanding of theoretical and applied aspects as well as methodology to solve multidisciplinary real-life problems.

**PEO-2.** To produce professional graduates ready to work with a sense of responsibility, and ethics and enable them to work efficiently individually and as a team.

**PEO-3.** To impart competency in students so that they can pursue higher studies and research in areas of engineering and other professionally related fields.

**PEO-4.** To inculcate the ability to adapt to changing technology through continuous learning.

6. **Programme Outcomes (POs)**

| Serial Number | Graduate Attribute Theme | The Complete PO Statement |
|---|---|---|
| | | After the successful completion of the BCA program, the graduates will be able to: |
| PO-1. | Knowledge Application | Apply the knowledge of mathematics, management, and computer applications to the solution of complex real-world problems. |
| PO-2. | Problem Analysis | Identify, formulate, review, and analyze complex problems reaching substantiated conclusions using principles of mathematics, management sciences, and computer applications. |
| PO-3. | Design And Development of Solutions | Design solutions for complex real-world problems and design system components or processes that meet the specified needs with appropriate consideration for health and safety, and cultural, societal, and environmental considerations. |
| PO-4. | Modern Tool Usage | Create, select, and apply appropriate techniques, resources, and modern computer software and IT tools including prediction and modeling to complex software engineering activities with an understanding of the limitations. |
| PO-5. | Environment And Sustainability | Understand the impact of professional software engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| PO-6. | Ethics | Apply ethical principles and commit to professional ethics and responsibilities and norms of the development practice. |
| PO-7. | Individual and Teamwork | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |

| PO-8. | Communication | Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
|---|---|---|
| PO-9. | Project Management and Finance | Demonstrate knowledge and understanding of the software engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO-10. | Life-Long Learning | Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

7. **Programme Specific Outcomes (PSOs)**

At the end of the BCA program, the graduate will be able to:

**PSO-1.** Ability to analyze, design, implement and test software systems based on requirement specifications and development methodologies of software systems.

**PSO-2.** Develop the applications to solve computational tasks and model real-world problems using appropriate programming language, data structure, and algorithms.

**PSO-3.** Ability to explore application-based technological advancements in various domains, evaluate their merits and identify research gaps to provide solutions to new ideas and innovations.

## 8. Program Structure:

| Semester 1 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type* | Course Code | Course Title | Credits |
| 1 | DSC | OBC101 | Computational Thinking and Fundamentals of IT | 3 |
| 2 | DSC | OBC102 | Foundations of Computer Programming | 4 |
| 3 | DSC | OBC103 | Mathematical Foundations of Computer Science | 3 |
| 4 | AEC | OBC104 | Professional English Skills | 3 |
| 5 | GE | **General Elective - 1** | | 3 |
| | | OBC105A | Principles and Practices of Management | |
| | | OBC105B | Introduction to Business Accounting | |
| 6 | DSC | OBC106 | C Programming Laboratory | 2 |
| 7 | SEC | OBC107 | Digital Productivity Tools for Moden Workplaces | 2 |
| 8 | SEC | OBC108 | Seminar - 1 | 1 |
| 9 | VAC | OBC109 | General Proficiency/NCC/Sports/Yoga/ Healthy Living and Fitness | 1 |
| | | | **Total Credits Over the Semester** | **22** |

| *DSC: Discipline-Specific Core Course | DSE: Discipline-Specific Elective Course | GE: General Elective Course |
|---|---|---|
| AEC: Ability Enhancement Course | SEC: Skill-Enhancement Course | VAC: Value Addition Course |

| Semester 2 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Credits |
| 1 | DSC | OBC201 | Data Structures and File Organization | 4 |
| 2 | DSC | OBC202 | Introduction to Object-Oriented Programming | 3 |
| 3 | DSC | OBC203 | Introduction to Operating Systems | 3 |
| 4 | DSC | OBC204 | Discrete Mathematics | 3 |
| 5 | GE | **General Elective - 2** | | 2 |
| | | OBC205A | Indian Culture | |
| | | OBC205B | Fine and Performing Arts | |
| 6 | VAC | OBC206 | Indian Constitution | 0 |
| 7 | AEC | OBC207 | Environmental Science | 2 |
| 8 | DSC | OBC208 | Data Structures Laboratory | 2 |
| 9 | DSC | OBC209 | Object-Oriented Programming Laboratory | 2 |
| 10 | VAC | OBC210 | General Proficiency/NCC/Sports/Yoga/ Seminar/Science of Happiness | 1 |
| | | | **Total Credits Over the Semester** | **22** |

| Semester 3 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Credits |
| 1 | DSC | OBC301 | Web Application Development | 3 |
| 2 | DSC | OBC302 | Introductions to Database Management Systems | 3 |
| 3 | DSC | OBC303 | Digital Logic Design | 3 |
| 4 | DSC | OBC304 | Python Programming | 3 |
| 5 | DSE | **Discipline-Specific Elective - 1** | | 3 |
| | | OBC305A | Probability and Statistics | |
| | | OBC305B | R Programming | |
| | | OBC305C | Principles of Programming Languages | |
| 6 | AEC | OBC306 | Skills for Career Success - 1 | 1 |
| 7 | DSC | OBC307 | Database Management Systems Laboratory | 2 |
| 8 | DSC | OBC308 | Web Application Development Laboratory | 2 |
| 9 | SEC | OBC309 | Mini Project - 1 | 2 |
| | | | **Total Credits Over the Semester** | **22** |

| Semester 4 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Credits |
| 1 | DSC | OBC401 | Introduction to Design and Analysis of Algorithms | 3 |
| 2 | DSC | OBC402 | Introduction to Software Engineering | 3 |
| 3 | DSC | OBC403 | Computer Organization | 3 |
| 4 | DSC | OBC404 | Data Communications and Computer Networks | 3 |
| 5 | DSE | **Discipline-Specific Elective - 2** | | 3 |
| | | OBC405A | Big Data Analytics | |
| | | OBC405B | Introduction to UNIX | |
| | | OBC405C | Management Information Systems | |
| 6 | SEC | OBC406 | Skills for Career Success - 2 | 1 |
| 7 | DSC | OBC407 | Design and Analysis of Algorithms Laboratory | 2 |
| 8 | DSC | OBC408 | Data Communications and Computer Networks Laboratory | 2 |
| 9 | SEC | OBC409 | Mini Project - 2 | 2 |
| | | | **Total Credits Over the Semester** | **22** |

| Semester 5 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Credits |
| 1 | DSC | OBC501 | Introduction to Java | 3 |
| 2 | DSC | OBC502 | Introduction to Artificial Intelligence | 3 |
| 3 | DSC | OBC503 | Introduction to Microcontrollers | 3 |
| 4 | GE | **General Elective - 3** | | 3 |
| | | OBC504A | Community Engagement and Social Responsibility | |
| | | OBC504B | Gardening and Horticulture | |
| 5 | DSE | **Discipline-Specific Elective - 3** | | 2 |
| | | OBC505A | UI-UX Design Fundamentals | |
| | | OBC505B | Object-Oriented Analysis and Design | |
| | | OBC505C | Introduction to .NET Programming | |
| 6 | SEC | OBC506 | Skills for Career Success - 3 | 1 |
| 7 | DSC | OBC507 | Artificial Intelligence Laboratory | 2 |
| 8 | DSC | OBC508 | Java Programming Laboratory | 2 |
| 9 | SEC | OBC509 | Mini Project - 3 | 3 |
| **Total Credits Over the Semester** | | | | **22** |

| Semester 6 | | | | |
|---|---|---|---|---|
| Sl. No. | Course Type | Course Code | Course Title | Credits |
| 1 | DSC | OBC601 | Introduction to Machine Learning | 4 |
| 2 | DSC | OBC602 | Introduction to Mobile Application Development | 3 |
| 3 | | **Discipline-Specific Elective - 4** | | 3 |
| | | OBC603A | Cryptography | |
| | | OBC603B | Network Security | |
| | | OBC603C | Cybersecurity | |
| 4 | | **Discipline-Specific Elective - 5** | | 3 |
| | | OBC604A | Computer Graphics | |
| | | OBC604B | Mobile Communication | |
| | | OBC604C | University-Approved MOOC or Certification | |
| 5 | | OBC605 | Mobile Application Development Laboratory | 2 |
| 6 | | OBC606 | Machine Learning Laboratory | 2 |
| 7 | | OBC607 | Capstone Project | 5 |
| **Total Credits Over the Semester** | | | | **22** |
| **Total Program Credits** | | | | **132** |

### 9. Programme Articulation Matrix (Course-PO-PSO Map)

| Sem. | Course Title | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Computational Thinking and Fundamentals of IT | | | | | | | | | | | | | |
| 1 | Foundations of Computer Programming | | | | | | | | | | | | | |
| 1 | Mathematical Foundations of Computer Science | | | | | | | | | | | | | |
| 1 | Professional English Skills | | | | | | | | | | | | | |
| 1 | Principles and Practices of Management | | | | | | | | | | | | | |
| 1 | Introduction to Business Accounting | | | | | | | | | | | | | |
| 1 | C Programming Laboratory | | | | | | | | | | | | | |
| 1 | Digital Productivity Tools for Moden Workplaces | | | | | | | | | | | | | |
| 1 | Seminar - 1 | | | | | | | | | | | | | |
| 1 | General Proficiency/NCC/Sports/ Yoga/Healthy Living and Fitness | | | | | | | | | | | | | |
| 2 | Data Structures and File Organization | | | | | | | | | | | | | |
| 2 | Introduction to Object-Oriented Programming | | | | | | | | | | | | | |
| 2 | Introduction to Operating Systems | | | | | | | | | | | | | |
| 2 | Discrete Mathematics | | | | | | | | | | | | | |
| 2 | Indian Culture | | | | | | | | | | | | | |
| 2 | Fine and Performing Arts | | | | | | | | | | | | | |
| 2 | Indian Constitution | | | | | | | | | | | | | |
| 2 | Environmental Science | | | | | | | | | | | | | |
| 2 | Data Structures Laboratory | | | | | | | | | | | | | |
| 2 | Object-Oriented Programming Laboratory | | | | | | | | | | | | | |
| 2 | General Proficiency/NCC/Sports/Yoga/ Seminar/Science of Happiness | | | | | | | | | | | | | |
| 3 | Web Application Development | | | | | | | | | | | | | |
| 3 | Introductions to Database Management Systems | | | | | | | | | | | | | |
| 3 | Digital Logic Design | | | | | | | | | | | | | |
| 3 | Python Programming | | | | | | | | | | | | | |
| 3 | Probability and Statistics | | | | | | | | | | | | | |
| 3 | R Programming | | | | | | | | | | | | | |
| 3 | Principles of Programming Languages | | | | | | | | | | | | | |
| 3 | Skills for Career Success - 1 | | | | | | | | | | | | | |
| 3 | Database Management Systems Laboratory | | | | | | | | | | | | | |
| 3 | Web Application Development Laboratory | | | | | | | | | | | | | |
| 3 | Mini Project - 1 | | | | | | | | | | | | | |
| 4 | Introduction to Design and Analysis of Algorithms | | | | | | | | | | | | | |
| 4 | Introduction to Software Engineering | | | | | | | | | | | | | |
| 4 | Computer Organization | | | | | | | | | | | | | |
| 4 | Data Communications and Computer Networks | | | | | | | | | | | | | |
| 4 | Big Data Analytics | | | | | | | | | | | | | |
| 4 | Introduction to UNIX | | | | | | | | | | | | | |
| 4 | Management Information Systems | | | | | | | | | | | | | |
| 4 | Skills for Career Success - 2 | | | | | | | | | | | | | |
| 4 | Design and Analysis of Algorithms Laboratory | | | | | | | | | | | | | |
| 4 | Data Communications and Computer Networks Laboratory | | | | | | | | | | | | | |
| 4 | Mini Project - 2 | | | | | | | | | | | | | |

| Sem. | Course Title | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | Introduction to Java | | | | | | | | | | | | | |
| 5 | Introduction to Artificial Intelligence | | | | | | | | | | | | | |
| 5 | Introduction to Microcontrollers | | | | | | | | | | | | | |
| 5 | Community Engagement and Social Responsibility | | | | | | | | | | | | | |
| 5 | Gardening and Horticulture | | | | | | | | | | | | | |
| 5 | Discipline-Specific Elective - 3 | | | | | | | | | | | | | |
| 5 | UI-UX Design Fundamentals | | | | | | | | | | | | | |
| 5 | Object-Oriented Analysis and Design | | | | | | | | | | | | | |
| 5 | Introduction to .NET Programming | | | | | | | | | | | | | |
| 5 | Skills for Career Success - 3 | | | | | | | | | | | | | |
| 5 | Artificial Intelligence Laboratory | | | | | | | | | | | | | |
| 5 | Java Programming Laboratory | | | | | | | | | | | | | |
| 5 | Mini Project - 3 | | | | | | | | | | | | | |
| 6 | Introduction to Machine Learning | | | | | | | | | | | | | |
| 6 | Introduction to Mobile Application Development | | | | | | | | | | | | | |
| 6 | Cryptography | | | | | | | | | | | | | |
| 6 | Network Security | | | | | | | | | | | | | |
| 6 | Cybersecurity | | | | | | | | | | | | | |
| 6 | Computer Graphics | | | | | | | | | | | | | |
| 6 | Mobile Communication | | | | | | | | | | | | | |
| 6 | University-Approved MOOC or Certification* | | | | | | | | | | | | | |
| 6 | Mobile Application Development Laboratory | | | | | | | | | | | | | |
| 6 | Machine Learning Laboratory | | | | | | | | | | | | | |
| 6 | Capstone Project | | | | | | | | | | | | | |

*The CO-PO-PSO mapping depends on the course/certification chosen by the student.

10. **Programme Regulations:** The regulations guiding this programme are available in the Program Guide.

# OBC101 - Computational Thinking and Fundamentals of IT

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 1 |
| Course Title | Computational Thinking and Fundamentals of IT |
| Course Code | OBC101 |
| Course Credits | 3 |
| Course Type | Core Course |

## 1. Course Summary

The aim of this course is to familiarize students with the fundamental concepts and principles of computational thinking and information technology. The course emphasizes the pillars of computational thinking, including problem-solving strategies and algorithmic thinking. Additionally, the course covers the basic components of computer systems, including hardware and software, operating systems, data communication, and programming languages. Overall, the course provides an overview of the field of computational thinking and information technology. By the end of the course, students will be able to develop algorithms to solve real-world problems.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Recall the fundamental concepts of computational thinking and problem-solving strategies. [L-1]
**CO-2.** Explain the importance of algorithmic thinking and develop basic algorithms. [L-2]
**CO-3.** Analyze the functional units of a computer. [L-3]
**CO-4.** Evaluate the different types of computer storage and software. [L-4]
**CO-5.** Synthesize the knowledge of number systems and data communication. [L-5]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to Computational Thinking and Problem Solving**<br>• What is Computational Thinking<br>• How is computational thinking used<br>• Information and Data: Converting Information into Data<br>• Data Types:<br>   o Numbers<br>   o Text<br>   o Colors<br>   o Pictures<br>   o Sound<br>• Classic Puzzle Solving<br>• General Problem Solving Techniques<br>• Pseudocode |

| | |
|---|---|
| 2 | **Unit 2: Algorithmic Thinking** |
| | • Flowchart |
| |     o  Definition of Flowchart |
| |     o  Advantages of flowchart |
| |     o  Flowchart symbols |
| |     o  Examples of flowchart (Sequential, branching, looping) |
| | • Algorithms |
| |     o  Definition of Algorithm |
| |     o  Characteristics of an Algorithm |
| |     o  Examples of Algorithm (sequencing, selection, iteration) |
| 3 | **Unit 3: Introduction to Computers and Basic Computer Organization** |
| | • Definition of a computer |
| | • Characteristics of a computer |
| | • Evolution of computers |
| | • Functional Units of a computer |
| | • Generations of computers |
| | • Classification Of computers |
| | • Applications of computers |
| | • Capabilities and limitations of a computer |
| | • Role of I/O devices in a computer system |
| | • Input Units |
| |     o  Keyboard |
| |     o  Mouse |
| |     o  Joystick |
| |     o  Scanner |
| |     o  Microphone |
| |     o  Webcam |
| |     o  Voice Recognition System |
| |     o  Touch Screen |
| | • Output Units |
| |     o  Monitors and its types |
| |     o  Printers and its types |
| |     o  Speakers |
| |     o  Plotters |
| |     o  Projectors |
| |     o  Sound cards |
| 4 | **Unit 4: Computer Storage and Software** |
| | • Data storage and retrieval methods |
| | • Primary Storage |
| |     o  RAM |
| |     o  ROM |
| |     o  PROM |
| |     o  EPROM |
| |     o  EEPROM |
| | • Secondary Storage |
| |     o  Magnetic Tapes |
| |     o  Magnetic Disks |
| |     o  Cartridge tapes |
| |     o  Hard disks |
| |     o  Floppy disks |
| |     o  Optical Disks |
| |     o  Compact Disks |
| |     o  Zip Drive |
| |     o  Flash Drives |
| |     o  Solid State Drives |
| | • Software and its needs |

| | | • System Software<br>   o   Operating System<br>   o   Utility Programs<br>• Operating System<br>   o   Objectives and functions<br>   o   Assemblers<br>   o   Compilers and Interpreters<br>   o   Multiprogramming<br>   o   Multitasking<br>   o   Multiprocessing<br>   o   Time Sharing<br>   o   DOS<br>   o   Windows<br>   o   Unix/Linux<br>• Application Software<br>   o   Word Processing<br>   o   Spreadsheets<br>   o   Presentation<br>   o   Graphics<br>   o   DBMS Software<br>• Programming Languages<br>   o   Machine Language<br>   o   Assembly Language<br>   o   High-Level Language |
|---|---|---|
| 5 | | **Unit 5: Number System and Data Communication**<br>• Decimal number system<br>• Binary number system<br>• Octal number system<br>• Hexadecimal number system<br>• Conversions<br>   o   Binary ↔ Decimal<br>   o   Binary ↔ Octal<br>   o   Binary ↔ Hexadecimal<br>   o   Octal ↔ Decimal<br>   o   Hexadecimal ↔ Decimal<br>   o   Octal ↔ Hexadecimal<br>• Complement<br>   o   1's Complement<br>   o   2's Complement<br>• Signed and Unsigned numbers<br>• Binary Coded Decimal (BCD)<br>• Gray code<br>• Data communication<br>   o   Definition of data communication<br>   o   Components of data communication<br>• Types of data communication<br>• Types of Networks<br>   o   Local Area Networks (LANs)<br>   o   Metropolitan Area Networks (MANs)<br>   o   Wide Area Networks (WANs)<br>   o   Wireless<br>• Introduction to network protocols |

**4. Course Articulation Matrix (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|--------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | | 2 | 3 | | | | 1 | | 1 | 2 | 3 | |
| CO-2 | 3 | 2 | 3 | 1 | | | | 2 | | 1 | 2 | 3 | 2 |
| CO-3 | 3 | 3 | 3 | 2 | | | | 2 | | 1 | 3 | 3 | 2 |
| CO-4 | 3 | 2 | 3 | 2 | | | | 2 | | 1 | 3 | 2 | 2 |
| CO-5 | 3 | 3 | 3 | 2 | | | | 2 | | 2 | 3 | 3 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

### a. Essential Reading
1. Norton, P., & Peter, C. (2017). Introduction to computers (8th ed.). McGraw-Hill.
2. Riley, D., & Hunt, K. (2014). Computational thinking for the modern problem solver. Chapman & Hall/CRC.
3. Spraul, V. A. (2012). Think like a programmer: An introduction to creative problem solving. No Starch Press.

### b. Recommended Reading
1. Leon, A., & Leon, M. (2021). Introduction to computers (8th ed.). Vikas Publishing.
2. Sinha, P. K., & Sinha, P. (2021). Computer fundamentals (6th ed.). BPB.
3. Xu, Z., & Zhang, J. (2021). Computational thinking: A perspective on computer science (1st ed.). Springer.
4. Zingaro, D. (2020). Algorithmic thinking: A problem-based introduction (1st ed.). No Starch Press.

### c. Magazines and Journals
1. IEEE Transactions on Computers
2. Journal of Computational Thinking Education, Springer

### d. Websites
1. https://www.coursera.org/learn/computational-thinking-problem-solving
2. https://onlinecourses.swayam2.ac.in/cec19_cs06/preview

### e. Other Electronic Resources
1. https://scratch.mit.edu/
2. https://academy.cs.cmu.edu/

# OBC102 – Foundations of Computer Programming

| Program | Bachelor of Computer Applications |
|---------|-----------------------------------|
| Semester | 1 |
| Course Title | Foundations of Computer Programming |
| Course Code | OBC102 |
| Course Credits | 4 |
| Course Type | Core Course |

## 1. Course Summary

The aim of this course is to create a strong foundation in C programming. The students are taught the basic components of C programming language and the process of their implementation. The students are taught algorithms, flowcharts, different C programming constructs, built-in and derived data structures, operators, and functions. This course also emphasizes dynamic memory allocation using pointers and various file-handling functions. Students are trained to employ the principles of C programming to develop suitable computer programs for the given problem.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Explain the basics of C programming language [L-1]
**CO-2.** Demonstrate the concept of arrays, structures, unions, and pointers [L-2]
**CO-3.** Apply control and looping structures to solve problems [L-3]
**CO-4.** Analyze a solution to large world problem using library and user-defined functions [L-4]
**CO-5.** Create C programs with file manipulation functions for applications with large amounts of data. [L-6]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to Programming in C** <br> • History of C, Structure of a C Program <br> • printf(), scanf(), Hello World Program, Format Specifiers, Single Character input/output, Formatted input/output Functions, commenting and documentation, indentation and formatting guidelines <br> • Constants and variables, Types of Constants, Keywords, Rules for identifiers, The character set <br> • Built-in data types: int, float, char, double, long, void <br> • Operators: Arithmetic Operators, Increment and Decrement Operators, Relational Operators, Logical Operators, Bitwise Operators, Conditional Operators, Type Conversions, and expressions, Precedence, and associativity of operators |
| 2 | **Unit 2: Control Flow and Branching** <br> • Simple if, if-else, nested if-else, the if-else ladder <br> • Unconditional branching using the goto statement <br> • break and continue <br> • the switch statement <br> • for, while, and do-while loop <br> • Importance of Programming Style for readability and maintainability, Code organization <br> • Debugging importance, tools common errors: syntax, logic and runtime errors, debugging, and Testing C Programs |
| 3 | **Unit 3: Functions, Pointers** <br> • Library Functions <br> • User Defined Functions, Function Prototype, Function Definition, and Function Call, Types of User-Defined Functions <br> • Passing and returning parameters to and from Function <br> • Storage classes: automatic, static, register, external <br> • Need of Pointers, Pointer Variables, Address, and dereferencing Operators <br> • Pointer Arithmetic |

| | |
|---|---|
| | • Dynamic Memory Allocation, Comparison of static and dynamic memory allocation, malloc () and free () Functions<br>• Pointers and Strings |
| 4 | **Unit 4: Arrays, Strings**<br>• One-dimensional arrays: Declaration, initialization, Operations on a one-dimensional array, lists, searching, sorting<br>• Multi-dimensional arrays: Declaration, initialization, Examples of Matrix Operations using Two-dimensional arrays.<br>• Declaring and Initializing Strings, String Input/Output gets(), puts(), fgets(), fputs() , and String Handling Functions |
| 5 | **Unit 5: Structures, Unions, and File Handling**<br>• Define Structure, Declaration, and Initialization<br>• Structure Variables, Array of Structures, and Use of typedef<br>• Passing Structures to Functions<br>• Define union, Declaration, and Initialization<br>• Passing structures to functions<br>• Opening and Closing a Data File<br>• File Modes and Operations<br>• File Input, and Output, Functions related to Data File Manipulations |
| 6 | **Unit 6: Preprocessor, Recursion**<br>• Preprocessor Definition<br>• Macro Substitution directives<br>• File Inclusion Directives<br>• Command Line Arguments<br>• Recursion: Definition, Need of Recursion<br>• Applications of Recursion in Real World<br>• Examples: Factorial, Fibonacci Series |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 3 | 2 | | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 |
| CO-2 | 3 | 3 | 3 | 2 | | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| CO-3 | 2 | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO-4 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO-5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

### a. Essential Reading

1. E. Balaguruswamy, 2019, Programming in ANSI C, 8th Edition, McGraw Hill Education, ISBN: 978-93-5316-513-0

### b. Recommended Reading

1. Byron S Gottfried, 2018, Programming with C, 4th Edition, Schaum Outlines
2. Herbert Schildt, 2000, C: The Complete Reference, 4th Edition, Tata McGraw-Hill Education Pvt. Ltd.
3. Yashavant P. Kanetkar, 2019, Let Us C, 16th Edition, BPB Publications, ISBN: 978-93- 8728-449-4.

**c. Magazines and Journals**
1. Code Journal
2. CS Bits and Bytes

**d. Websites**
1. https://www.coursera.org/specializations/c-programming 2. https://nptel.ac.in/courses/106104128
**e. Other Electronic Resources**
1. https://www.learn-c.org/
2. https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/

# OBC103 - Mathematical Foundations of Computer Science

| Programme | Bachelor of Computer Applications |
|---|---|
| Semester | I |
| Course Title | Mathematical Foundations of Computer Science |
| Course Code | OBC103 |
| Course Credit | 3 |
| Course Type | Core Theory Course |

### 1. Course Summary

Computer Applications features a significant course known as Mathematical Foundations of Computer Science. This course imparts foundational mathematical concepts relevant to computer applications. It entails a comprehensive exploration of set theory, including advanced topics. Additionally, number theory principles are introduced to the students. The course equips them with the skills to define and utilize relations and functions. The learners are also trained to apply mathematical induction for the purpose of theorem proving. Students are trained to calculate determinants. The learners are exposed to the properties of matrix addition and multiplication.

### 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1. Define and identify the basic concepts of set theory, relations and number theory. [L-1]

CO-2. Interpret Venn-Euler diagrams, relations, functions, matrices and determinants. [L-2]

CO-3. Use mathematical induction to prove mathematical statements. [L-3]

CO-4. Analyze the properties of integers using the Euclidean algorithm and prime factorization. [L-4]

### 3. Course Contents

| Sr. No | Units |
|---|---|
|  |  |

| 1 | **Unit 1: Set Theory** |
|---|---|
| | ▪ Introduction |
| | ▪ Set and its Elements |
| |     ➢ Elements of a Set |
| |     ➢ Standard Sets and Symbols |
| | ▪ Set Description |
| |     ➢ Roster Method |
| |     ➢ Set Builder Method |
| | ▪ Cardinal Number (Dimension or Order) of a Set |
| | ▪ Types of Sets |
| | ▪ Venn-Euler Diagrams |
| | ▪ Set Operations and Laws of Set Theory |
| |     ➢ Union of Sets |
| |     ➢ Intersection of Sets |
| |     ➢ Disjoint Sets |
| |     ➢ Difference of Two Sets |
| |     ➢ Complement of a Set |
| |     ➢ Distributive Laws |
| |     ➢ Symmetric Difference of Sets |
| | ▪ Fundamental Products |
| | ▪ Index and Indexed Sets |
| | ▪ Partitions of Sets |
| | ▪ Minsets |
| | ▪ Countable and Uncountable Sets |
| | ▪ Algebra of Sets and Duality |
| | ▪ Computer Representation of Sets |
| | The Inclusion and Exclusion Principle |

| | |
|---|---|
| 2 | **Unit 2: Relations and Functions** <br><br> ■ Introduction <br> ■ Cartesian Product of Sets <br>     ➢ The Cartesian Product of n Sets <br>     ➢ Important Results on Cartesian Product <br> ■ Binary Relations <br>     ➢ Binary Relation Defined in a Set <br>     ➢ Domain and Range of a Relation <br> ■ Set Operations on Relations <br> ■ Types of Relations <br>     ➢ Properties of Relations <br> ■ Partial Order Relations <br> ■ Equivalence Relation <br> ■ Functions: Introduction <br> ■ Definition and Notation of a Function <br>     ➢ Range and Domain of a Function <br>     ➢ Function as Sets of Ordered Pairs <br>     ➢ Difference between Relation and Function <br>     ➢ Difference between a Function and its Value <br> ■ Types of Functions <br> ■ Invertible Functions <br> ■ Composition of Functions <br>     ➢ Important Results on Composition of Functions <br> ■ Identity Function <br> ■ Functions for Computer Science <br>     ➢ Floor and Ceiling Functions <br>     ➢ Fibonacci Sequence <br>     ➢ Ackermann's Function <br>     ➢ Characteristic Function <br>     ➢ Mod Functions <br>     ➢ Time-complexity Function |
| 3 | **Unit 3: Number Theory** <br> ■ Introduction <br> ■ Basic Properties of Integers <br> ■ Properties of Integers <br> ■ Division Theorem (or Algorithm) <br> ■ Greatest Common Divisor <br>     ➢ Basic Properties of the Greatest Common Divisor <br> ■ Euclidean Algorithm <br>     ➢ Basic Properties of Prime Factors <br> ■ Least Common Multiple <br> ■ Testing for Prime Number |

| 4 | **Unit 4: Mathematical Induction, Recursion and Fundamentals of Probability Theory** |
|---|---|
| | ▪ Introduction<br>▪ Principle of Mathematical Induction<br>▪ Recursive Definitions and Structural Induction<br>▪ Recursive Algorithms<br>▪ Introduction to Probability Theory<br>▪ Concepts of Probability<br>    ➢ Random Experiment<br>    ➢ Sample Space<br>    ➢ Types of Events |
| 5 | **Unit 5: Determinants and Matrices**<br>▪ Introduction to Determinant<br>▪ Determinant as Eliminant<br>▪ Minor<br>▪ Cofactor<br>▪ Rules of Sarrus<br>▪ Properties of Determinants<br>▪ Introduction to Matrices<br>▪ Types of matrices<br>▪ Addition of Matrices<br>▪ Properties of Matrix Addition<br>▪ Subtraction of Matrices<br>▪ Scalar Multiple of a Matrix<br>▪ Matrix Multiplication<br>▪ Properties of Matrix Multiplication |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO-1** | **PO-2** | **PO-3** | **PO-4** | **PO-5** | **PO-6** | **PO-7** | **PO-8** | **PO-9** | **PO-10** | **PSO-1** | **PSO-2** | **PSO-3** |
| **CO-1** | 2 | 3 | 2 | | | | | | | 2 | 2 | 2 | 1 |
| **CO-2** | 3 | 3 | 3 | | | | | | | 2 | 2 | 2 | 2 |
| **CO-3** | 3 | 3 | 2 | | | | | | | 2 | 1 | 1 | |
| **CO-4** | 2 | 3 | 2 | | | | | | | 1 | 1 | 1 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

### 1. Essential Reading

    a. J. K. Sharma., 2005, Discrete Mathematics, 4th Ed., Trinity Press.

    b. H. K. Dass., 2012, Advanced Engineering Mathematics, 21st Ed., S. Chand and Company Ltd.

### 2. Recommended Reading

    a. Kenneth. H. Rosen., 2012, Discrete Mathematics and its Applications, 7th Ed., McGraw Hill.

b.  Gremaldi, Ramana., 2006, Discrete and Combinatorial Mathematics, 5th Ed., Pearson Publishers.

# OBC104 – Professional English Skills

| Program | BCA |
|---|---|
| Semester | 1 |
| Course Title | Professional English Skills |
| Course Code | OBC104 |
| Course Credit | 3 |
| Course Type | Core Theory |

## 1. Course Summary

Profound Communication skills are an essential part of professional life. This course aims to provide comprehensive input on business communication and help the students know how to overcome various communication barriers in their work life. Students are taught several business letters writing techniques, including digital communication that can be applied in their work settings. Focus is also given to employability skills required to get into the right job. This course is structured in a way in which the students can learn how to present themselves in front of the public.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Understand the importance of business communication.[L-1]
**CO-2.** Identify the areas and ways to improve the effectiveness of communication skills.[L-2][L-3]
**CO-3.** Application of proper writing techniques in business documents. [L-3]
**CO-4.** Analyze the efficacy of different communication mediums.[L-4]
**CO-5.** Assess the impact of internal and external communication.[L-5]
**CO-6.** Evaluate the strengths and importance of workplace etiquette and manners.[L-5]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to Business Communication, Process and Barriers:**<br>• Introduction<br>• Definitions<br>• Nature of Business Communication<br>• Scope of Business Communication<br>• Objectives Business Communication<br>• Need for Business Communication<br>• Communication Process<br>• 7 Cs of Communication<br>• Barriers to Business Communication<br>• Ways to Overcome the Barriers |
| 2 | **Unit 2: Importance & Types of Communication:**<br>• Introduction<br>• Role of Communication in Management<br>• Flow of Communication<br>• Grapevine Communication<br>• Methods of communication: |

| | |
|---|---|
| | o *Formal and Informal Communication* |
| | o *Verbal and non-verbal communication* |
| | o *Internal and External Communication* |
| | • Facing today's Communication Challenges |
| 3 | **Unit 3: Written Communication - Business Letter Writing and Other Forms of Written Communication - Electronic Communication and PowerPoint Presentations** |
| | • Introduction |
| | • Soft Skills |
| | • Written Communication |
| | • Essentials of Good Writing |
| | • Improving Writing Techniques |
| | • Ethics in Writing |
| | • Meaning of Business Letter |
| | • Principles of Business Letter Writing |
| | • Components of Business Letter |
| | • The layout of Business Letters |
| | • Cover letter |
| | • Offer Letter |
| | • Acceptance letter |
| | • Business Messages and Goodwill Messages |
| | • Writing Memorandum |
| | • Notice and Circular Writing |
| | • Agenda and Minutes of the Meeting |
| | • Business Report |
| | • Courteous Phrases |
| | • Proofreading |
| | • Email Writing |
| | • Importance of Digital Communication |
| | • Tools of social media like What's App, Zoom, Teams |
| | • Importance and Styles PowerPoint Presentation |
| | • Delivering Presentations Effectively (Introduction to Kinesics) |
| 4 | **Unit 4**: **Effective Handling of Issues, Public Speaking and Group Communication:** |
| | • Introduction |
| | • Handling Complaints Effectively |
| | • Giving and Receiving Feedback |
| | • Negative News Handling |
| | • Listening Skills |
| | • Techniques of Public Speaking |
| | • Importance of Public Speaking |
| | • Modes of public speaking |
| | • Ways to Reduce Stage Fright |
| | • Types of Meetings |
| | • Seminars and Conferences. |
| | • Group Discussions-Do's and Don'ts |
| 5 | **Unit 5: Resume Writing, Interviews and Business Etiquette:** |
| | • Introduction |
| | • Format of Resume writing |
| | • Professional Resume |
| | • Job Application |
| | • Definition |
| | • Preparation |
| | • Types |
| | • Do's and Don'ts |
| | • Mock Interviews |

| | | | | | |
|---|---|---|---|---|---|
| | • Introduction to Business Etiquette | | | | |
| | • Power Dressing | | | | |
| | • Telephonic Etiquette | | | | |
| | • Table Etiquette | | | | |

4. **Course Articulation Matrix (CO-PO-PSO Map)**

| - | Program Outcomes (POs) | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PSO-1 | PSO-2 | PSO-3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | 1 | 2 | **1** | **2** | **3** |
| CO2 | 3 | 3 | 2 | 2 | 3 | - | 1 | 1 | **2** | **2** | **1** |
| CO3 | 3 | 2 | 2 | 2 | 3 | - | 2 | 1 | **-** | **2** | **3** |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | 1 | 1 | **1** | **2** | **-** |
| CO5 | 2 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | **3** | **2** | **-** |
| CO6 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | **-** | **2** | **3** |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | |

**5. Course Resources**

a) **Essential Readings:**

1. Self-Learning Material.
2. Raymond, V. L., Marie, E. Flatley., Rentz, K. & Pande, N. (2009). Business Communication: Making Connections in a Digital World ( 13/ed.). TMH. New Delhi.
3. Meenakshi Raman and Prakash Singh. (2012). Business Communication. (2ed.). Oxford University Press.
4. Urmila Rai and S.M. Rai.(2020). Business Communication. (9/ed). Himalaya Publishing house.

b) **Recommended Reading:**

1. Hudson R.H. and Selzler B.J. (2006). Business Communication Concepts and Applications in an Electronic Age. (5/ed.). Jaico Reprint, Jaico, New Delhi.
2. Booher, D. (2001). E-Writing: 21st Century Tools for Effective Communication. New York: Pocket Books, Division of Simon & Schuster, Inc.
3. Sinha, k.k (2017). Business Communication. (Fourth Revised Edition). Taxman.
4. C.C. Pattensheti. Business Communication. Chand and Company Publishers. New Delhi.
5. Herta A. Murphy., and Charles E. Peck. Effective Business Communication. Tata McGraw Hill Publishing Company Limited. New Delhi.
6. Peter Hartley., and Clive, G. Bruckmann. (2002). Business Communication. Routledge. London.

c) **Other Electronic Resources:** Course Video Lectures

# OBC105A- Principles and Practices of Management

| Programme | Bachelor's in Computer Application |
|---|---|
| Semester | I |
| Course Title | Principles and Practices of Management |
| Course Code | OBC105A |
| Course Credits | 3 |
| Course Type | Core Theory Course |

## 1. Course Summary

Principles and Practices of Management is an introductory course that provides students with an overview of the management process from a manager's perspective. The course seeks to help students acquire the knowledge, skills, and abilities needed to successfully manage organizations. Throughout the course, students will examine the logic and workings of organizations and learn about the major functions of management. The main objective of this course is to help students become familiar with a variety of management principles and practices. By the end of the course, students will have acquired the necessary knowledge, skills, and abilities to effectively manage organizations in a variety of settings.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe theoretical aspects , process and principles, scope of management and its application to modern management practice.[L-1]

**CO-2.** Define the roles and responsibilities of a manager in the organization. [L-2]

**CO-3** Illustrate the importance of planning, organizing, staffing ,directing and controlling in decision making .[L-3]

**CO-4.** Interpret the ability of communication, leadership, directing and controlling skills.[L-3]

**CO-5.** Evaluate the contemporary issues and challenges in management.[L-5]

## 3. Course Contents

| Unit 1: Introduction to Management |
|---|
| <ul><li>Definition of Management</li><li>Meaning of Management,</li><li>Significance of Management</li><li>Nature and Purpose of Management</li></ul> |

- The Evolution of Management Thoughts
- Roles of Manager
- The Function of Manager: Planning, Organising, Staffing, Leading and Controlling: an overview.
- Coordination: The Essence of Management
- Management and Administration

## Unit 2: Planning

- Meaning of Planning
- Nature of Planning
- Importance of Planning
- Types of Plans
- Steps in Planning
- Management by Objectives
- Barriers to Effective Planning

## Unit 3:Organising

- Meaning of Organising
- Nature of Organising
- Departmentalisation
- Organisation Levels
- Span of Management
- Organizational Structure
- Process of Organising
- Principles of Organising
- Decentralisation of Authority
- Delegation of Authority

## Unit 4: Staffing

- Definition of Staffing
- Process of Staffing Function
- Importance of Staffing
- Manpower Planning
- The System Approach to Human Resource Management
- Recruitment
- Selection
- Performance Appraisal.

## Unit 5: Leading and Controlling

- Introduction to Motivation
- McGregor Theory of X and Y
- Maslow Hierarchy of Needs Theory
- Herzberg's Motivation-Hygiene Theory
- Meaning of Leadership
- Traits and Qualities of a good leader
- Leadership Styles
- Importance of Leadership
- Communication Definition
- Process of Communication
- Barriers of Effective Communication
- Importance of Communication
- Communication Types.

- Controlling Definition
- Controlling Process,
- Controlling as a Feed Back System
- Importance of Controlling
- Major Controlling Techniques.

## 4. Course Articulation Matrix (CO-PO-PSO)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PSO-1 | PSO-2 | PSO-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Programme Outcomes (POs)** | | | | | | | **Programme Specific Outcomes (PSOs)** | | |
| CO1 | 3 | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 | 3 | 2 | 2 |
| CO2 | 2 | - | - | - | - | 2 | 3 | 3 | 1 | 2 | 3 | 2 | - |
| CO3 | 3 | 2 | | - | - | 2 | 3 | 2 | - | 1 | 2 | 1 | - |
| CO4 | 1 | 1 | - | - | - | 2 | 2 | 3 | 1 | - | 3 | - | - |
| CO5 | 1 | - | 1 | - | - | 2 | 2 | 2 | 1 | 1 | 2 | 2 | - |
| | | | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | |

## 5. Course Resources

### a. Essential Reading

1. Course Self-Learning Material
2. T.N Chhabra, Principles and Practice of Management, 9th Ed., Dhanpat Rai & Co. (P) Ltd., New Delhi

### b. Recommended Reading

1. Dr. L.M. Prasad, Principles & Practice of Management, 10th Ed., Sultan Chand &Sons - New Delhi
2. P.C. Tripathi and Reddy, Principles of Management, 4th Ed., Tata McGraw Hill, New Delhi

### c. Websites

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

### d. Other Electronic Resources

Course Video Lectures on Bright space

# OBC105B- Introduction to Business Accounting

| Program | Bachelor of Computer Application |
|---|---|
| Semester | 1 |
| Course Title | Introduction to Business Accounting |
| Course Code | OBC105B |
| Course Credit | 3 |
| Course Type | Core Theory Course |

## 1. Course Summary

The aim of this course is to create a foundation of Financial Accounting. The students are taught the basic concepts of accounting and the process for implementation. The students are also taught the mechanics of preparation of Journal, Ledger, Trial Balance, and interpretation of Financial Statements. The students will be able to analyze the Cash flow and Fund Flow Statements. This course also emphasizes the students to analyze the reasons for the difference in cash book and passbook balance by preparing the Bank Reconciliation Statement.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Identify the basic terms and summarize the fundamental concepts of Accounting[L-1]
**CO-2.** Describe the regulatory framework of the operations of the accounting activities[L-2]
**CO-3.** Apply the conceptual knowledge in the process of recording the transactions in various books of accounts [L-3]
**CO-4.** Classify the various accounts and analyze the need for preparing financial statements [L-4]
**CO-5.** Analyze and evaluate the financial performance of business entities [L-5]

## 3. Course Contents

| Sl. No. | Units | Unit Objectives |
|---|---|---|
| 1 | **Unit 1: Introduction to Accounting**<br>• Meaning<br>• Nature and scope of Financial Accounting<br>• Branches of Accounting<br>• Functions of Accounting<br>• Users of financial information | 1. Define Accounting.<br>2. Explain the nature and scope of accounting.<br>3. Identify the various users of accounting information. |
| 2 | **Unit 2: Accounting Principles**<br>• Accounting Concepts<br>• Accounting conventions<br>• Accounting Equations and illustrations | 1. Discuss the basic principles, concepts, and conventions.<br>2. Explain the accounting equation. |

| | | |
|---|---|---|
| 3 | **Unit-3: Accounting Standards in India**<br>• Accounting Concepts<br>• Accounting Conventions<br>• Benefits of Accounting Standards<br>• Procedure for issuing accounting standards in India | 1. List the concept and benefits of accounting standards.<br>2. Acquire knowledge about the Indian accounting standards. |
| 4 | **Unit 4: Double Entry System**<br>• Meaning<br>• Classification of accounting transactions and accounts<br>• Golden Rules of Accounting.<br>• Importance of Double entry system<br>• Simple illustrations | 1. Learn the doubleentry system.<br>2. Know the importance of double entry<br>3. Learn the rules of debit and credit. |
| 5 | **Unit 5: Financial Accounting Process**<br>• Journal<br>• Ledger accounts<br>• Simple problems | 1. Explain the accounting process.<br>2. Demonstrate how the entries are passed through the accountingcycle. |
| 6 | **Unit 6: Trial Balance**<br>• Meaning<br>• Features<br>• Objectives<br>• Methods<br>• Steps in locating errors disclosed by trial balance and suspense account | 1. Summarizes the accounts.<br>2. Listing the errorsdisclosed by the trial balance by preparing suspense account. |
| 7 | **Unit 7: Subsidiary Books**<br>• Meaning<br>• Significance<br>• Types of subsidiary books- Purchases Book, Sales Book, Purchase Returns Book, Sales Returns Book | 1. Recognize the types of subsidiary books.<br>2. Acquire skills in recording transactions in subsidiary books. |
| 8 | **Unit 8: Final Accounts**<br>• Meaning<br>• Objectives of Final Accounts<br>• Importance of Final Accounts<br>• Preparation of Trading Account & P r ofit and loss a/c<br>• Preparation of Balance Sheet.<br>• Simple Illustrations | 1. Describe the importance of final accounts<br>**2.** Develop the skill in the preparation of Final accounts**.** |
| 9 | **Unit 9: Final Accounts with Adjustments**<br>• Adjustments<br>• Closing stock<br>• Outstanding expenses<br>• Prepaid expenses<br>• Depreciation<br>• Provision for bad debts | 1. Analyze the entries that need adjustments.<br>2. Compute by adjusting post-balance sheet date entries affectingfinal accounts. |
| 10 | **Unit 10: Cash Flow Statement**<br>• Meaning<br>• Importance of Cash Flow Statement,<br>• Preparation of Cash Flow Statement as per AS 3 | 1. Apply the knowledge for the preparation ofcash flow statement. |

| | | |
|---|---|---|
| | • Illustrations. | |
| 11 | **Unit 11: Fund Flow Statement**<br>• Meaning<br>• Importance of Fund Flow Statement<br>• Preparation of Fund Flow Statement<br>• Illustrations. | 1. Recognize and apply the knowledge for the preparation of fund flow statement. |
| 12 | **Unit 12: Bank Reconciliation Statement (BRS)**<br>• Introduction<br>• Importance of Bank Reconciliation Statement (BRS)<br>• Ascertaining the causes of differences of Bank Balance inBank Column of the Cash- Book and in Pass- Book.<br>• Procedure for Reconciling the Cash- Book Balance with thePassbook balance.<br>• Simple illustrations | 1. Examine the differences of cash book and passb o o k balances.<br>2. Analyze the reasons for difference betweencash book and passbook balance |

4. **Course Articulation Matrix (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | Programme SpecificOutcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO-1** | **PO-2** | **PO-3** | **PO-4** | **PO-5** | **PO-6** | **PO-7** | **PO-8** | **PO-9** | **PO-10** | **PSO-1** | **PSO-2** | **PSO-3** |
| **CO-1** | 2 | 2 | 1 | - | - | - | 1 | - | 1 | 1 | - | - | - |
| **CO-2** | 1 | 1 | 1 | - | - | - | 2 | - | 1 | 1 | - | - | - |
| **CO-3** | 2 | 1 | - | 2 | - | - | 1 | 1 | 1 | 1 | - | 2 | 1 |
| **CO-4** | - | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 1 |
| **CO-5** | - | 2 | 1 | 1 | 1 | - | 1 | - | - | - | 1 | 2 | 1 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

5. **Course Resources**

   a. **Essential  Reading**
      1. Course Self-Learning Material
      2. Raman, B.S., 2018, Financial Accounting (Vol.1), United Publishers.

   b. **Recommended Reading**
   1. Jain, S.P., Narang, K.L., 2019, Advanced Accountancy (Vol. 1), 22$^{nd}$ edition, KalyaniPublishers.
   2. Charles T. Horngren and Donna Philbrick, 2001, Introduction to Financial Accounting,Pearson Education.
   3. Ashish  Bhattacharya,  K., 2012, Essentials  of  Financial  Accountancy, 3$^{rd}$ Ed., PHI.
   4. Monga, J.R., 2007, Financial Accounting: Concepts and Applications. Mayur PaperBacks.
   5. Tulsian, P.C., 2009, Financial Accounting, 4$^{th}$ Ed., Pearson Education.
   6. Shukla, S.M., 2009, Financial Accounting, 4$^{th}$ Ed., Sahitya Bhawan Publications.

   c. **Websites**
      1. https://www.coursera.org/
      2. http://nptel.ac.in/
   d. **Other Electronic Resources**
      1. Course Video Lectures on Bright Space

# OBC106 – C Programming Laboratory

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 1 |
| Course Title | C Programming Laboratory |
| Course Code | OBC106 |
| Course Credits | 2 |
| Course Type | Core Theory Course |

### 1. Course Summary

The aim of this course is to analyze, design and develop C programs. The students are taught to develop C Programs using different data types, operators, control structures, and looping statements. The students are taught library and user-defined functions for solving large problems using a modular approach. This course emphasizes structured programming using C programming language with features of dynamic memory allocation and file-handling functions. Students are trained to create, debug, and test C programs.

### 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Demonstrate the use of a C compiler to develop, debug, and execute C programs with suitable test cases [L-1]

**CO-2.** Illustrate different data types, operators, control structures, and loops to solve a problem [L-2]

**CO-3.** Implement C programs using arrays, structures, and pointers [L-3]

**CO-4.** Apply user-defined and library functions to solve complex problems [L-4]

**CO-5.** Develop C programs using file-based functions, dynamic memory allocation, and string-related functions [L-5]

### 3. List of Experiments

| Sr. No | Name of Experiment | Learning Outcomes<br>After the successful completion of the unit, the learner should be able to: |
|---|---|---|

| 1 | Write a C program to exchange the values of two integer variables. | 1. Implement a C program using built-in data types. <br> 2. Illustrate the use of printf () and scanf () functions. |
|---|---|---|
| 2 | Write a C program to find the roots of quadratic equations. | 1. Illustrate the use of if-else structures. <br> 2. Apply library functions. |
| 3 | Write a C program to check whether the entered integer is a palindrome. | 1. Apply looping structures. <br> 2. Illustrate data types and operators. |
| 4 | Write a C program to sort the elements of an array in ascending order. | 1. Illustrate the use of arrays. |
| 5 | Write a C program to search for an element in an array. Display the position of the element. | 1. Demonstrate the use of arrays data structures, if-else, and loops. |
| 6 | Consider two matrices of the size m and n. Implement matrix multiplication operation and display results using functions. Write three functions 1) Read matrix elements 2) Matrix Multiplication 3) Print matrix elements | 1. Demonstrate multi-dimensional arrays and user-defined functions. |
| 7 | Consider two strings S1 and S2. Develop a C Program for the following operations. <br> a) Display a concatenated output of S1 and S2 <br> b) Count the number of characters and empty spaces in S1 and S2. | 1. Illustrate string-based functions and arrays. |
| 8 | Consider details of a bank account with the fields account number, account holder's name, and balance. Write a program to read 10 people's details and display the record with the highest bank balance. | 1. Demonstrate an array of structures. |
| 9 | Write a C program to demonstrate the use of & and * operators using pointers. Create and free a memory location for an integer. Display the address and data stored at the location. | 1. Illustrate pointers, malloc (), and free () functions. |
| 10 | Write a program to create a file called student.txt and store information about a student in terms of roll no, age, and marks. | 1. Illustrate the file pointers, file-related functions, and file modes. |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 2 | 2 | 2 | 2 | | | 1 | 1 | 2 | 1 | 3 | 3 | 1 |
| CO-2 | 3 | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 2 |
| CO-3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 3 | 1 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-4 | 3 | 3 | 3 | 2 | | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CO-5 | 3 | 3 | 3 | 2 | 1 | | 2 | 3 | 3 | 2 | 3 | 3 | 1 |

3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution

## 5. Course Resources

### a. Essential Reading
1. Course Self-Learning Material
2. E. Balaguruswamy, 2019, Programming in ANSI C, 8th Edition, McGraw Hill Education, ISBN: 978-93-5316-513-0

### b. Recommended Reading
1. Kernighan B.W and Dennis M. Ritchie, 2015, The C Programming Language, 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9
2. Yashavant P. Kanetkar, 2019, Let Us C, 16th Edition, BPB Publications, ISBN: 978-93- 8728-449-4.
3. Herbert Schildt, 2000, C: The Complete Reference, 4th Edition, Tata McGraw-Hill Education Pvt. Ltd.
4. B.A.Forouzan and R.F. Gilberg, 2007, Computer Science: A Structured Programming Approach Using C, 3rd Edition, Cengage Learning

### c. Magazines and Journals
1. Code Journal
2. CS Bits and Bytes

### d. Websites
1. https://www.coursera.org/
2. http://nptel.ac.in/

### e. Other Electronic Resources
1. Course Video Lectures on Brightspace LMS
2. https://ocw.mit.edu/index.htm
3. https://www.geeksforgeeks.org/c-programming-language/
4. https://www.onlinegdb.com/online_c_compiler

# OBC107 -Digital Productivity Tools for Modern Workplaces

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 1 |
| Course Title | Digital Productivity Tools for Modern Workplaces |
| Course Code | OBC107 |
| Course Credits | 2 |
| Course Type | Core Course |

### 1. Course Summary

This course is aimed at giving students hands-on exposure to managing an office with the help of computers and office productivity tools.

Students are exposed to the MS Windows computer and trained to perform various file and folder management tasks including opening, modifying, relocating, and deleting files and folders. The students are then trained in crafting professional Word documents, Excel spreadsheets, and PowerPoint presentations using the Microsoft Office suite of productivity tools. The course would enable the student to use digital computers effectively for documentation, spreadsheet computation, visualization, and slide presentation.

### 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO 1.** Manage the daily administration of a modern office with the help of digital computers and office productivity tools.

**CO 2.** Craft professional Word documents that include figures, tables, and mathematical equations.

**CO 3.** Create Excel worksheets with different types of data visualization elements.

**CO 4.** Prepare contemporary presentation slides with different types of animation and transition effects.

### 3. Course Contents

**Unit 1.** MS Windows Computers: File and folder management; Types of files, and how to open them; downloading and installing necessary applications.

**Unit 2.** MS Word: Creating documents, font and paragraph attributes, multi-column documents, insertion and formatting equations, tables, and figures; page numbers, headers, and footers; mail merging; document design and layouts, drawing tools.

**Unit 3.** MS Excel: Preliminaries: Gridlines, Format Cells, Summation, auto-fill, Formatting Text; Calculations, Cell Referencing, Formulae in Excel: average, standard deviation, Charts, bars, and other visualization tools, Renaming and Inserting worksheets, Hyperlinking, Count function; Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

**Unit 4.** PowerPoint Orientation, Slide Layouts, Inserting text, Word art, Formatting text, Bullets and Numbering, Auto Shapes, Lines and Arrows; Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables, and Charts; Master layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes, etc.), Inserting Background, textures, Design templates, Hidden slides; Auto content wizard; Slide transition, Custom animation, Auto rehearsing

### 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 2 | 1 | 3 | 1 | 1 | 2 | 2 | | 1 | 2 | 1 | |
| CO-2 | 2 | | | 3 | 1 | | 1 | 2 | | 1 | | | |
| CO-3 | 2 | | | 3 | 1 | | 1 | 2 | | 1 | | | |
| CO-4 | 2 | | | 3 | 1 | | 1 | 2 | | 1 | | | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

    a. **Essential Reading**
   1. Mark Edward Soper (2018) Easy Windows 10. Pearson Education.
   2. Gupta, V., (2005) Comdex Information Technology Course Kit. Wiley Dreamtech Press.

    b. **Recommended Reading**
   1. Ed Bott, Carl Siechert, and Craig Stinson (2010). Windows 7: Inside Out. Microsoft Press.

# OBC108 - Seminar

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 1 |
| Course Title | Seminar |
| Course Code | OBC108 |
| Course Credits | 1 |
| Course Type | Skill Enhancement Course |

## 1. Course Summary

This course is aimed at giving students hands-on practice in the independent critical reading of scientific articles from journals and other sources. The student is required to choose a topic of interest, access resources for the survey and collection of data, analyze and interpret the data, and draw meaningful conclusions.

Students will be expected to familiarize themselves with the technical advances in computer applications.

They are encouraged to get acquainted with the emerging social, ethical, and legal aspects of computer applications, research, and development. The student will be guided to conduct a literature review, and study methodology, technology, tools, and processes used in contemporary computer applications. They will be guided to summarize and prepare a report followed by a seminar presentation.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO 1.** Identify a topic in Computer Applications and conduct a thorough literature review independently.
**CO 2.** Discuss the importance of the selected topic with respect to research, relevance, and its applications in the global and local context.
**CO 3.** Justify the importance of the selected topic.
**CO 4.** Prepare a detailed report on the selected topic and defend the conclusions drawn in a visual presentation.

## 3. Course Contents

**Unit 1.** Identification of a topic for the seminar in consultation with the course instructor/seminar guide

**Unit 2.** Conducting a literature review on the selected topic, collecting relevant data, and critically analyzing the collected data

**Unit 3.** Making meaningful conclusions based on the literature review and data analysis.

**Unit 4.** Preparation of a detailed report on the selected topic to bring out the important concepts in the selected area, relevance, and applications of the topic.

**Unit 5.** Preparation of a presentation of the summary of the report and presenting it to a panel of examiners.

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | | 2 | | | | | | | | | | | |
| CO-2 | 2 | 3 | | | | | | | | | 2 | | |
| CO-3 | 2 | 3 | | | | | | | | | 2 | | |
| CO-4 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | 3 |

**5. Course Resources**

    **a. Essential Reading**
       1. Bright, S. (2020). Microsoft PowerPoint: Creating a Presentation, Tips for Creating and Delivering an Effective Presentation, and Marketing Your Brand Through PowerPoint Presentation. United Kingdom: Lulu.com.

    **b. Recommended Reading**
       1. The seminar guide shall recommend the resources based on the elected topics.

# OBC109- Healthy Living and Fitness

| Program | Bachelor of Computer Applications |
| --- | --- |
| Semester | 1 |
| Course Title | Healthy Living and Fitness |
| Course Code | OBC109 |
| Course Credits | 1 |
| Course Type | Value Addition Course |

| Course Outcome | • The benefits of healthy lifestyle |
| --- | --- |
| | • Importance of balanced food and proper diet in daily |
| | • Problems related to addiction and benefits of yoga |
| | • Basic first aid procedures. |

**Details of the Course:**

| Sl. No. | Contents | Contact Hours |
| --- | --- | --- |

| | | |
|---|---|---|
| 1 | **Human Body**<br><br>Awareness of important body organs, their location and broad functions.<br><br>**Diet and Health**<br><br>Importance of breakfast, fruits, whole grains<br>Knowledge about constituents of diet, proteins, fats, carbohydrate, vitamins and minerals.<br>Importance of fiber. | **2** |
| 2 | **Life style Diseases**<br><br>Harmful effects of junk/ processed foods. Dangers<br>of obesity<br>Diseases ensuing because of lifestyle eg. Diabetes, heart diseases etc. | **3** |
| 3 | **Exercise**<br><br>Benefits of exercise and yoga.<br>**Addictions**<br><br>Chewing/ unhealthy harmful products Drinking<br>Smoking | **3** |
| 4 | **Importance of Mental Health**<br><br>Stress management Anxiety<br><br>and depression<br><br>Awareness of commonly encountered diseases/ailments | **3** |
| 5 | **First Aid**<br><br>First aid in commonly encountered emergency | **1** |
| | **Total** | **12** |

| | | |
|---|---|---|
| 10. | **Mode of Evaluation** | Test / Quiz / Assignment / End Term Exam |

# BCA – II Semester Syllabus

# OBC201- Data Structures and File Organization

| Program | Bachelor of Computer Applications |
|---|---|
| **Semester** | 2 |
| **Course Title** | Data Structures and File Organization |
| **Course Code** | OBC201 |
| **Course Credits** | 3 |
| **Course Type** | Core Theory Course |

| 1. | Unit 1: Introduction<br>Basic Terminology, Algorithm complexity, Pointers and Dynamic Memory Allocation, Arrays: Introduction, One Dimensional Arrays, Multidimensional Arrays, Strings, Functions: introduction, Parameter Passing Techniques, Recursion: Definition, Types of Recursion, structures: Introduction to Structures, Nested Structures, Array of Structures, Pointers to Structures |
|---|---|
| 2. | Unit 2: Linked Lists<br>Introduction, Arrays and Linked Lists, Building a Linked List, Traversing the Linked List, Insert and Delete Operations, Searching in a Linked List, Circular Linked List, Doubly Linked List |
| 3. | Unit 3: Stacks and Queues<br>Stacks: Introduction, Applications of Stack, Array and Linked list implementations of a Stack, Infix, Prefix and Postfix Expressions, converting infix expressions to prefix and postfix forms, Evaluation of postfix expression<br>Queues: Introduction, Applications of Queue, Array and Linked List implementation of queues, Circular Queue, Doubly Ended Queue, Priority Queue |
| 4. | Unit 4: Searching and Sorting<br>Searching: Sequential Search, Binary Search, Hashing: Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation<br>Sorting: Bubble Sort, Selection Sort and Insertion Sort. |
| 5. | Unit 5: Trees<br>Trees: Basic Terminology, Binary Trees: Definition and properties of Binary Trees, Binary Tree Representation, Algebraic Expressions, Types of binary trees, Binary tree traversals. |

# OBC202 - Introduction to Object-oriented Programming

| | |
|---|---|
| **Programme** | Bachelor of Computer Applications |
| **Semester** | 2 |
| **Course Title** | Introduction to Object-oriented Programming |
| **Course Code** | OBC202 |
| **Course Credits** | 3 |
| **Course Type** | Core Theory Course |

## 1. Course Summary

This course aims to develop programming skills using object-oriented programming (OOP). The students are taught the basic concepts including data abstraction, encapsulation, inheritance, dynamic binding, etc. The students are taught to learn OOP concepts using the C++ programming language. The basic components of C++ including classes and objects, constructors, destructors, and inheritance, etc. are taught to the students. This course emphasizes function and operator overloading for developing simple C++ programs. Students are also trained to develop C++ programs using data file input/output operations, generic templates, and exception handling.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Discuss OOP features that are essential for building good C++ programs [L-1]
**CO-2.** Explain arrays, functions, classes, and objects to write C++ programs [L-2]
**CO-3.** Implement C++ Programs using constructors, destructors, and operator overloading [L-3]
**CO-4.** Use public and private inheritance features in problem-solving [L-4]
**CO-5.** Apply classes and objects with virtual functions and file manipulation functions [L-5]
**CO-6.** Develop C++ programs using generic templates and exception handling [L-6]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: OOP and Introduction to C++**<br>• OOP Concepts: Encapsulation, Abstraction, Inheritance, Data Hiding, Message Passing<br>• Benefits of OOP, Procedure-oriented versus OOP<br>• Structure of a C++ Program, Tokens, Identifiers, Variables, and Constants<br>• Built-in data types, Operators, Precedence and Associativity Operators<br>• Control Structures: if, if-else, nested if, switch<br>• while, do-while, for, break, and continue |

| 2 | **Unit 2: User-defined Functions, Arrays, Structures, Unions, Pointers** |
|---|---|
|   | • Functions – Library and User-define Functions, Function Prototype, Definition and Call, |
|   | • Inline Functions, Function Overloading |
|   | • Array - Single-dimensional array and Multidimensional Array |
|   | • Structures - Declaring and defining a structure, Accessing structure members |
|   | • Unions - Declaring and defining a union, Initialization, and access of union variables |
|   | • Pointers - Pointers and their characteristics, Pointer declaration and assignment, Pointer arithmetic, Dynamic memory allocation using new and delete operators |
| 3 | **Unit 3: Classes and Objects** |
|   | • Classes and Objects |
|   | • Defining Classes, Instantiating Objects, and Member Functions |
|   | • Accessibility Labels: public, private, protected |
|   | • Inline and non-inline function |
|   | • Scope resolution operators |
|   | • Function overloading (Polymorphism) |
|   | • Constructors and Destructors, Default Constructors, Parameterized Constructors, Copy Constructor, Purpose of the Constructors, Destructors |
|   | • Static Members (variables and functions) |
|   | • An array of Objects, Class Pointers |
|   | • Friend Functions and Friend Class. |
| 4 | **Unit 4: Inheritance, Operator Overloading, and Type Conversion** |
|   | • Concept of Reusability |
|   | • Types of Inheritance: Single, Hierarchical, Multilevel, Multiple Inheritance and Hybrid Inheritance |
|   | • Operator Overloading: Overloading Unary and Binary Operators by using member functions OR friend functions. Overloading various operators [++/-- (used as pre and post operators), arithmetic(+, -, *, /, ^), relational (<, <=, >, >=, !=, ==), assignment (=), extraction (>>) and insertion (<<) operators) |
|   | • Type conversion in C++: Primitive data type to class type conversion, Class to Primitive data type conversion, Class to Class conversion. |
| 5 | **Unit 5: Virtual Functions, File Handling, Exception Handling, and Templates** |
|   | • Abstract Class, Function Overriding, Dynamic Binding, Pure Virtual Functions |
|   | • Data Ambiguity and Virtual Inheritance |
|   | • File Classes (C++ stream classes), Opening, and Closing of a File, File Modes, I/O operations in Files |
|   | • I/O using primitive data type: Formatted I/O in files, I/O using the class's object |
|   | • Generic programming approach using templates: Template functions, Template class, Overloading template functions, using different classes as a data type in the template class. Inheritance of template class, STL: an overview, vectors, containers, lists, and map. |
|   | • Exception Handling in C++: Introduction to exceptions, exceptions, and errors, types of exceptions, Using try, catch blocks, throw various types of exceptions including class. |

**4. Course Articulation Matrix (CO-PO-PSO Map)**

|  | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| **CO-1** | 2 | 2 | 1 | 1 | 1 |  |  | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| **CO-2** | 3 | 3 | 2 | 2 | 2 |  | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 |
| **CO-3** | 3 | 3 | 2 | 2 | 2 |  | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 |
| **CO-4** | 3 | 3 | 3 | 2 | 2 |  | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 3 |
| **CO-5** | 3 | 3 | 3 | 3 | 2 |  | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| **CO-6** | 3 | 3 | 3 | 3 | 2 |  | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
|  | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | |

**5. Course Resources**

    a. **Essential Reading**

        1. E. Balagurusamy. (2011), Object Oriented Programming with C++, 4th Edition, Tata McGraw Education Hill

        2. Herbert Schildt, (2003), The Complete Reference C++, 4th Edition, Tata McGraw Hill

    b. **Recommended Reading**

        1. Robert Lafore, (2008), Object Oriented Programming with C++, 4th Edition, Pearson Education India

        2. Stephen Prata, (1995), C++ Primer Plus: teach Yourself Object Oriented Programming, 2nd Edition, Waite Group

    c. **Magazines and Journals**

        1. C/C++ User Journal, CMP Media, Inc.

    d. **Websites**

        1. https://www.udemy.com/topic/c-plus-plus/free/

        2. https://archive.nptel.ac.in/courses/106/105/106105151/

    e. **Other Electronic Resources**

        1. https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/pages/lecture-notes/

        2. https://www.programiz.com/cpp-programming

# OBC203 – Introduction to Operating System

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 2 |
| Course Title | Introduction to Operating Systems |
| Course Code | OBC203 |
| Course Credits | 3 |
| Course Type | Core Theory Course |

## 1. Course Summary

This course provides an understanding of the concepts and principles of operating systems. It covers the fundamental topics of process management, memory management, and storage management. The course also delves into the structures of operating systems, such as operating-system services, user and operating-system interfaces, and system calls. Additionally, the course covers critical topics like processes, threads, process synchronization, CPU scheduling, deadlocks, and memory management. Students gain a comprehensive understanding of the fundamental concepts and principles of operating systems.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Define the role and function of operating systems in computer systems [L-1]
**CO-2.** Describe different types of operating systems, services provided by OS, and the components of OS. [L-2]
**CO-3.** Describe and execute process synchronization, including synchronization hardware, mutex locks, semaphores, and monitors [L-3]
**CO-4.** Compare different process scheduling algorithms [L-4]
**CO-5.** Evaluate the efficiency of different memory management techniques. [L-5]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to OS(9hrs)**<br>• What Operating Systems Do<br>• Computer-System Organization<br>• Computer-System Architecture<br>• Operating-System Structure<br>• Operating-System Operations<br>• Basics of Process Management<br>• Memory Management<br>• Storage Management<br>• Protection and Security<br>**Operating-System Structures**<br>• Operating-System Services<br>• User and Operating-System Interface<br>• System Calls<br>• Types of System Calls<br>• System Programs<br>• Operating-System Structure |
| 2 | **Unit 2: Processes Management(9hrs)**<br>**Processes**<br>• Process Concept<br>• Process Scheduling<br>• Operations on Processes<br>• Interprocess Communication<br>• Examples of IPC Systems<br>**Threads**<br>• Overview<br>• Multicore Programming<br>• Multithreading Models<br>• Thread Libraries<br>• Implicit Threading<br>• Threading problems |
| 3 | **Unit 3: Process Synchronization (9hrs)**<br>• Background<br>• The Critical-Section Problem<br>• Peterson's Solution<br>• Synchronization Hardware<br>• Mutex Locks<br>• Semaphores<br>• Classic Problems of Synchronization<br>• Monitors |

| 4 | **Unit 4: CPU Scheduling and Deadlocks(9hrs)**<br>• CPU Scheduling Basic Concepts<br>• Scheduling Criteria<br>• Scheduling Algorithms<br>• Real-Time CPU Scheduling<br>• Deadlock -System Model<br>• Deadlock Characterization<br>• Methods for Handling Deadlocks<br>• Deadlock Prevention<br>• Deadlock Avoidance<br>• Deadlock Detection<br>• Recovery from Deadlock |
|---|---|
| 5 | **Unit 5: Memory management (9hrs)**<br>• Main Memory<br>• Swapping<br>• Contiguous Memory Allocation<br>• Segmentation<br>• Paging<br>• Structure of the Page Table<br>• Virtual memory<br>• Demand Paging<br>• Copy-on-Write<br>• Page Replacement<br>• Allocation of Frames<br>• Thrashing |

**4. Course Articulation Matrix (CO-PO-PSO Map)**

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| **CO-1** | 3 | | 2 | | | | | | | 1 | 2 | 2 | 2 |
| **CO-2** | 3 | | 3 | | | | | | | 1 | 2 | 2 | 2 |
| **CO-3** | 3 | | 2 | | | | | | | 1 | 2 | 2 | 2 |
| **CO-4** | 3 | 3 | 3 | | | | | | | 1 | 2 | 2 | 2 |
| **CO-5** | 3 | 3 | 3 | | | | | | | 2 | 2 | 2 | 2 |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

**5. Course Resources**

    **a. Essential Reading**
1. Course Self-Learning Material
2. Abraham Silberschatz, Peter B Galvin, Greg Gagne, "Operating System Concepts", Wiley India Pvt. Ltd 2018, 9th Edition,.

    **b. Recommended Reading**
1. William Stallings, "Operating Systems Internals and Design Principles", Pearson, 2018, 9th Edition.
2. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", Pearson 2014, 4th Edition.

    **c. Websites**
1. https://www.coursera.org/
2. http://nptel.ac.in/

# OBC204 - Discrete Mathematics

| Programme | Bachelor of Computer Applications |
|---|---|
| **Semester** | 2 |
| **Course Title** | Discrete Mathematics |
| **Course Code** | OBC204 |
| **Course Type** | Core Theory Course |

## 1. Course Summary

This undergraduate course in discrete mathematics for computer applications provides students with a solid foundation in key mathematical concepts and problem-solving techniques relevant to computer science. The course covers a range of topics including fundamental principles of counting, fundamentals of logic, properties of integers, mathematical induction, relations and functions, and the principle of inclusion and exclusion. Throughout the course, students engage in problem-solving activities, proofs, and exercises that reinforce their understanding of the topics covered. The course aims to equip students with the necessary mathematical foundations and logical reasoning skills essential for various aspects of computer applications, including algorithms, data structures, cryptography, and more.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Recall the fundamental principles of counting, concepts and rules of logic [L-1]

**CO-2.** Comprehend the concepts and applications of mathematical induction [L-2]

**CO-3.** Apply techniques of counting in the analysis of algorithms [L-3]

**CO-4.** Analyze and solve counting problems using the principle of inclusion and exclusion[L-6]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Fundamental principles of Counting**<br><br>▪ The Rules of Sum and Product<br><br>▪ Permutations<br><br>▪ Combinations: The Binomial Theorem<br><br>▪ Combinations with repetitions |

| 2 | **Unit 2 – Fundamentals of Logic** |
|---|---|
| | ▪ Basic Connectives and Truth Tables |
| | ▪ Logical Equivalence: The Laws of Logic |
| | ▪ Logical Implication: The Rules of Inference |
| | ▪ The Use of Quantifiers |
| | ▪ Quantifiers, Definitions and the proofs of theorems |
| 3 | **Unit 3 – Properties of Integers: Mathematical Induction** |
| | ▪ The well ordering Principle: The Mathematical Induction |
| | ▪ Recursive Definitions |
| | ▪ The Division Algorithm: Prime Numbers |
| | ▪ The Greatest Common Divisor: The Euclidean Algorithm |
| | ▪ The Theorem of arithmetic |
| 4 | **Unit 4 – Relations and Functions** |
| | ▪ Cartesian Products and Relations |
| | ▪ Functions: Plain and One-to-One |
| | ▪ Onto Functions: Sterling Numbers of the Second Kind |
| | ▪ Special Functions |
| | ▪ The Pigeon hole Principle |
| 5 | **Unit 5 – The Principle of Inclusion and Exclusion** |
| | ▪ The Principle of Inclusion and Exclusion |
| | ▪ Generalization of the Principle |
| | ▪ Derangements: Nothing is in its Right Place |
| | ▪ Rook Polynomials |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| **CO-1** | 2 | 3 | 3 | | | | | | | 1 | 1 | 2 | 1 |
| **CO-2** | 2 | 3 | 3 | | | | | | | 1 | 1 | 2 | |
| **CO-3** | 3 | 3 | 3 | | | | | | | 1 | 1 | 3 | 2 |
| **CO-4** | 2 | 3 | 3 | | | | | | | | | 1 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

### a. Essential Reading

1. Gremaldi, Ramana., 2006, Discrete and Combinatorial Mathematics, 5th Ed., Pearson Publishers.
2. Kollman, Busby and Ross., 2015, Discrete mathematical Structures, 3rd Ed., Pearson Publishers.

### b. Recommended Reading

1. Susanna Epp, 2010, Discrete Mathematics with Applications, 4th Ed., Wadsworth Publishing Co Inc.
2. Kenneth Rosen, 2021, Discrete Mathematics and its Applications, 8th Ed., McGraw Hill.

# OBC205A – Indian Culture

| Program | Bachelor of Computer Applications |
|---|---|
| **Semester** | 2 |
| **Course Title** | Indian Culture |
| **Course Code** | OBC205A |
| **Course Credits** | 2 |
| **Course Type** | Generic Elective Course |

## 1. Course Summary

The course aims to provide a comprehensive exploration of India's rich and diverse cultural heritage. It also provides an understanding of the history, geography, and regional variations within Indian culture. The students are exposed to cultural aspects including languages, literature, architecture, visual and performing arts, and the significance of food, costumes, and festivals in Indian society. The course also examines the social structure of India, socio-cultural issues, the spread of Indian culture abroad, and the influence of globalization. The course also emphasizes the importance of cultural sensitivity and respect in a diverse society, illustrating intercultural collaborations and exchanges.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe various aspects of Indian culture [L-1]
- **CO-2.** Explain the cultural influences, regional variations, and historical developments within Indian culture [L-2]
- **CO-3.** Examine the cultural significance of various architectural styles, artistic expressions, and performing arts forms. [L-3]
- **CO-4.** Analyze the impact of globalization on Indian culture and society [L-4]
- **CO-5.** Create an inclusive environment by developing cultural sensitivity and respect in a diverse society [L-6]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to Indian Culture**<br>• Culture an introduction<br>• Overview of Indian Culture: Historical Evolution from Ancient to Modern India<br>• Cultural and regional variations within India<br>• Influence of globalization on Indian culture<br>• Importance of cultural sensitivity and respect in a diverse society |
| 2 | **Unit 2: Languages and Literature**<br>• Indian languages and literature<br>• Ancient texts, manuscript system, and inscriptions<br>• Indian knowledge system in the past and philosophical traditions |
| 3 | **Unit 3: Indian Architecture**<br>• Indian architectural styles and traditions |

| | | | | |
|---|---|---|---|---|
| | • Archaeological and heritage sites of India | | | |
| | • Indian rivers- cultural lifelines | | | |
| 4 | **Unit 4: Visual Arts & Performing Arts**<br>• Indian painting traditions<br>• Sculpture and handicraft<br>• Classical Music<br>• Drama<br>• Dance forms<br>• Indian folklore | | | |
| 5 | **Unit 5: Food, Costume and Festivals**<br>• Indian spices and condiments, diversity in Indian cuisine<br>• Ayurveda and Yog<br>• Martial Arts<br>• From handlooms to the present fashion industry<br>• Festivals across all religions and their cultural significance<br>• Rituals and traditions associated with fairs and festivals | | | |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PSO-1 | PSO-2 | PSO-3 |
| **CO-1** | 1 | | 3 | | 2 | 3 | 3 | 1 | 1 | 3 | | 2 | |
| **CO-2** | 1 | | 3 | | 1 | 3 | 3 | 1 | 1 | 3 | | 2 | |
| **CO-3** | | | 3 | | 2 | 1 | 2 | 2 | 1 | 3 | | | 2 |
| **CO-4** | 1 | | 3 | | 1 | 1 | 3 | | | 3 | | 2 | |
| **CO-5** | 2 | 1 | 3 | | | 3 | 3 | 2 | 1 | 3 | | 2 | |
| 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | |

## 5. Course Resources

    **a. Essential Reading**
       1. Pattanaik Devdutt, 2021, Indian Culture, Art & Heritage, Pearson

    **b. Recommended Reading**
       1. Nehru, Jawaharlal, 1946, Discovery of India, Jawaharlal Nehru Memorial Fund
       2. Husain S. Abid, 1978, The National Culture of India, 14th Ed., National Book Trust

    **c. Websites and Other Electronic Resources**
       1. https://www.indiaculture.gov.in/
       2. https://www.youtube.com/watch?v=ymoKnBGSFGM
       3. https://www.caleidoscope.in/
       4. https://marg-art.org/

# OBC206 Indian Constitution

| Program: - | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Semester** | | **Course Title** | | **Constitution of India** | **Code** | | |
| **Course Components** | | **Credits** | | **Contact Hours** | **L** | **T** | **P** |
| Core Course (CC) | | 02 | | | 03 | 00 | 00 |
| **Examination Duration (Hrs)** | | **Theory** | **Practical** | **WEIGHTAGE: EVALUATION** | | | |
| | | 03 | 00 | | | | |
| **Pre-requisite** | NIL | | | | | | |
| | | | | | | | |

| **Course Outcomes** | |
|---|---|
| CO1 | Develop a comprehensive understanding of the Indian Constitution, its historical context, and the fundamental principles that underpin it |
| CO2 | Explore the significance of constitutional concepts, such as the Rule of Law, Separation of Powers, and the Basic Structure Theory, in upholding democracy |
| CO3 | Analyze the interplay between Fundamental Rights, Fundamental Duties, and Directive Principles in ensuring social justice and governance in India. |
| CO4 | Gain insight into the functioning of key institutions, including the Union and State Legislature, Executive, and Local Self-Government, and understand their roles in the democratic system |
| CO5 | Examine the structure and functions of the Indian judiciary, the principles of judicial review, and the importance of Public Interest Litigation (PIL) in safeguarding constitutional values |

| **Unit No.** | **Content** | **Contact Hours** |
|---|---|---|
| **Unit -0** | **Pre-requisites, Key Concepts, and Terminology:** Introduction to the course and its objectives. The State and its significance in constitutional studies. Difference between a "Person" and a "Citizen" in a legal context. Concept of "Citizen" within a constitutional framework. Importance of the "Rule of Law" in a democratic society. Structure of Government and Constitutional Principles. Overview of the Organs of the State and their functions. Concept of "Separation of Powers" and its role in a constitutional democracy. "Basic Structure Theory" and its significance in constitutional interpretation. | 8 |
| **Unit -1** | **Historical Background and Philosophy of Indian Constitution:** Introduction to constitutional concepts. Defining "Constitution" and "Constitutionalism." Importance of a constitution in governance and democracy. Comparative analysis of various constitutions | 10 |

| | around the world. The role of constitutionalism in preserving fundamental rights. Introduction to the period from the 1773 Regulating Act to the Mountbatten Plan. Review of salient features of the Indian Constitution. **Introduction to the Preamble and its significance**: Detailed analysis of the terms "Secular," "Democratic," and "Socialist." | |
|---|---|---|
| **Unit -2** | **Introduction to Fundamental Rights and Duties:** Overview of Fundamental Rights and their significance in a democratic society. Discussion on Fundamental Duties and their role in promoting civic responsibilities. **Fundamental Rights (Article 12 - 21):** Understanding the Concept of the State (Article 12). Exploring Judicial Review and its role (Article 13). In-depth analysis of Fundamental Rights, including equality, freedom, and protection against discrimination (Articles 14-19). Rights of Accused Persons and the right to a fair trial (Article 20). Right to Life and Personal Liberty, including landmark cases (Article 21). Constitutional Remedies and Directive Principles (Article 32, 36-51). Constitutional Remedies (Writs) and their significance (Article 32). **Directive Principles of State Policy**: understanding the socio-economic objectives (Articles 36-51). The relationship between Fundamental Rights and Directive Principles. **Fundamental Duties (Article 51A) and Landmark Cases** | 10 |
| **Unit -3** | **Union and State Legislature and Executive:** Parliament – Lok Sabha, Rajya Sabha. State Legislature – Legislative Council, Legislative Assembly. President – Powers and Functions. Prime Minister and the Council of Ministers. Governor - Powers and Functions. Chief Minister and the Council of Ministers. Nature, scope, and extent of executive power (power of union and states: article 73 and 162). Relationship of the President/Governor with the Council of Ministers. Emergency provisions. | 9 |
| **Unit -4** | **Introduction to Local Self-Government and Judicial Structure:** Introduction to Local Self-Government. Overview of local self-government systems in India and their importance. Historical development and the need for decentralization. **Panchayati Raj (73rd Amendment):** -Introduction to the 73rd Amendment and its objectives. Structure and functions of Panchayats. Devolution of powers to Panchayats. **Urban Local Bodies (74th Amendment):** -Introduction to the 74th Amendment and its significance in urban governance. Structure and functions of Urban Local Bodies. **Introduction to** | 8 |

| | Judicial Structure: Overview of the Indian judiciary and its role in upholding the Constitution. Supreme Court, High Court, and Subordinate Courts.            Introduction to the Supreme Court, its jurisdiction, and its significance. Role and functions of High Courts in the Indian legal system. Understanding the functions of Subordinate Courts. The hierarchy of courts and the principle of judicial review. **PIL, Judicial Activism, and Judicial Overreach:** Introduction to Public Interest Litigation (PIL) and its importance. Understanding the concept of judicial overreach and its limitations. Amendment to the Constitution (Article 368).            Introduction to the process of amending the Constitution under Article 368. Different types of amendments and their implications. | |
|---|---|---|
| | Total Hours | 45 |

**Text Book:**

| Authors Name | Title | Edition | Publisher, Country | Year |
|---|---|---|---|---|
| J. N Pandey | Constitutional Law of India | 58th Edition | Central Law Agency | 2023 |
| P M Bakshi | Constitution of India | 19th Edition | Lexis Nexis, Delhi | 2023 |

**Reference Book:**

| Authors Name | Title | Edition | Publisher, Country | Year |
|---|---|---|---|---|
| V N Shukla | Constitution of India | 14th Edition | Eastern Book Company | 2024 |
| M P Jain | Indian Constitutional Law | 8th Edition | Lexis Nexis, Delhi | 2022 |

# OBC 207 Environmental Science

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

**CO1** Describe the key environmental issues and display awareness

**CO2** Encourage participation in environmental conservation practices.

**CO3** Develop critical thinking and apply those to the analysis of a problem or question related to the   environment.

**CO4** Evaluate impact of various human induced activities on the environment

**CO5** Design possible solutions to the real environmental problems.

**CO6** Create research and innovation related with different aspects of environmental science

## Unit 1: Environmental Science and Ecosystem (08 hours)

**a**. Definition of Environmental Science, multidisciplinary nature, Objective, scope and importance.

**b**. Concept of an ecosystem, structure and function, energy flow, ecological succession, food chains, food webs, ecological pyramids.

**c**. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

## Unit 2: Natural Resources and Biodiversity (16 hours)

**a**. Renewable and non- renewable resources.

**b**. Natural resources and associated problems:

- **Forest resources**: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people.

- **Water Resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems, water conservation, rainwater harvesting, watershed management.

- **Mineral Resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

- **Food Resources:** World food problems, Changes in land use by agriculture and grazing, Effects of modern agriculture, Fertilizer/ pesticide problems, Water logging and salinity

- **Energy Resources:** Increasing energy needs, Renewable/ non-renewable, Use of

Alternate energy sources, urban problems related to energy, Case studies

- **Land resources:** Land as a resource, land degradation, man-induced land-slides, soil erosion and desertification, wasteland reclamation

**c**. Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

**d**. Definition of biodiversity, levels of biodiversity, value of biodiversity, threats to biodiversity (habitat loss, poaching of wildlife, man-wildlife conflicts).

**e**. Biodiversity at global, national and local levels, India as a biodiversity nation, bio-geographical classification of India, hotspots of biodiversity.

**f**. Endangered and endemic species of India.

**g**. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**Unit 3: Environmental Pollution (08 hours)**

a. Definition, causes, effects and control measures of Air Pollution, water pollution, soil pollution, marine pollution noise pollution, thermal pollution, nuclear hazards.

b. Solid waste Management: causes, effects and control measures of urban and industrial wastes

c. Role of an individual in prevention of pollution, pollution case studies, pollution case studies

**Unit 4: Important Environmental and Social Issues, Management and Legislation (14 Hours)**

a. Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocaust. Case studies.

b. Sustainable development, Resettlement and rehabilitation of people (its problems, concerns and case studies), Environmental ethics (issues and possible solutions), consumerism and waste products

c. Disaster management: floods, earthquake, cyclone and landslides.

d. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act,

e. Issues involved in enforcement of environmental legislation, Public Awareness

f. Population growth (variation among nation), Population explosion (family welfare program), Environment and human health, human rights, value education, HIV/

AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, case studies.

**Unit 5: Field work (01 Hour)**

    a. Visit to a local area to document environmental assets- river/ forest/ grasslands/ hill /mountain.

    b. Visit to a local polluted site- Urban/ Rural/ Industrial/ Agricultural

    c. Study of common plants, insects, birds

    d. Study of simple ecosystems- pond, river, hill slopes, etc.

**Learning Resources:**

1. **Joseph K. & Nagendran R**.: *Essentials of Environmental studies*; Pearson Edition

2. **Santra S. C**., *Environmental Science*; Central Book Agency.

3. **Dhameja, S. K*.,* Environmental Studies*; Katson books.

4. **Srivastava Smriti,** *Environmental Studies*; Katson books.

5. **Deswal, S. & Deswal A**., *A Basic Course in Environmental Studies*; Dhanpat Rai & Co.

# OBC208 - Data Structures Laboratory

| Program | Bachelor of Computer Applications |
|---|---|
| Semester | 2 |
| Course Title | Data Structures Laboratory |
| Course Code | OBC208 |
| Course Credits | 2 |
| Course Type | Core Practical Course |

## 1. Course Summary

The goal of this course is to lay a strong foundation for the organization of elementary data as well as structured data among learners. This course has been started by explaining the basic terms used in data structures for a better understanding of the learners. The learners are taught elementary data organization and dynamic memory allocation. The learners are also taught how to compare and analyze programs in terms of time & space complexity. In the subsequent lessons, various types of data structures like arrays, stacks, queues, and linked lists have been discussed and explained to the learners. In this course, the concepts of recursion and tail recursion have been discussed in depth. In this course, various concepts related to searching, such as sequential search, binary search, hash table, hash functions, and collision resolution strategies have been explained to the learners. This course also emphasizes different types of sorting techniques like insertion sort, bubble sort, quick sort, two-way merge sort, and heap sort. In the order of advanced data structure, different types of trees have been discussed first, and after that, the concept of graph, B trees, B+ trees, indexing, and hashing comparisons have been explained respectively.

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Define fundamental data structure concepts, compare and choose appropriate data structures to represent data items in the real world [L-2].

**CO-2.** Compare and analyze the merits and demerits of various data structures in terms of complexity [L-4].

**CO-3.** Design algorithms and develop programs using a variety of data structures such as arrays, stacks, queues, linked lists, graphs, and trees [L-6].

**CO-4.** Implement and evaluate operations like searching, insertion, deletion, traversing, and similar on various data structures [L-5].

**CO-5.** Understand, analyze and implement the concept of file structures and file organizations in data structures [L-6].

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction**<br>• Basic Terminology<br>• Pointer and dynamic memory allocation<br>• Elementary Data Organization<br>• Algorithm Complexity and Time-Space trade-offs |
| 2 | **Unit 2: List of Experiments** |
| I | Write a C Program to read n elements in an array and find the average.<br>• Use static memory allocation to allocate memory for the array.<br>• Use dynamic memory allocation to allocate memory for the array. |
| Ii | Write a C program using recursive functions to<br>a) Find the nPr.<br>b) Implement towers of Hanoi. |
| Iii | Write a C program to demonstrate the stack operations. Use array to represent the stack. |
| Iv | Write a C program to evaluate the postfix expression. |
| V | Write a C program to convert an infix expression to its postfix equivalent. |
| Vi | Write C programs to demonstrate the following data structures using arrays.<br>• Queue<br>• Circular queue |
| Vii | Write C programs to demonstrate the following operations on a linked list<br>Creation of a list<br>• Adding an element at the beginning of the list.<br>• Adding an element at the end of the list.<br>• Deleting the first element.<br>• Deleting the last element. |
| Viii | Write C program to create Binary Search Tree and perform the following<br>• Inorder traversal<br>• Preorder traversal<br>• Postorder traversal |
| Ix | Write C program to implement the following<br>• Linear search<br>• Binary search |
| X | Write C program to implement the following.<br>• Bubble sort<br>• Quick sort |
| Xi | Write C program to perform the following operations on a graph.<br>• Depth First Search<br>• Breadth First Search |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 | PSO-4 |
| CO-1 | 3 | 3 | 3 | 3 | 3 | | | | | 2 | 2 | 2 | | 3 | 1 | |
| CO-2 | 3 | 3 | 3 | 3 | 3 | | | | | 2 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO-3 | 3 | 3 | 3 | 3 | 3 | | | | | | 2 | 1 | | 2 | 1 | 1 |
| CO-4 | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 2 | 3 | 3 | 3 | 2 |
| CO-5 | 3 | 3 | 3 | 3 | 3 | | | | | | 3 | 2 | 2 | 2 | | 1 |
| | | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | |

## 5. CourseResources

### a. EssentialReading
1. Kruse, R. et al. (2006). *Data structures and program design in C*, 2nd Ed., Pearson India.

### b. Recommended Reading
1. Lipschutz, (2014). *Data structures*, 1st Ed., Tata McGraw-Hill.
2. Tenenbaum , A. M. et al. (2006). *Data structures using C*, 2nd Ed., Pearson Education.
3. Horowitz and Sahani. (1999). *Fundamental of data structures*, Galgotia Publishers.

### c. Websites and Other Electronic Resources
1. ACM Transactions on Algorithms
2. XRDS: Crossroads, The ACM Magazine for Students

# OBC209 - Object-Oriented Programming Laboratory

| Programme | Bachelor of Computer Applications |
|---|---|
| Semester | 2 |
| Course Title | Object-Oriented Programming Laboratory |
| Course Code | OBC209 |
| Course Credits | 02 |
| Course Type | Core Practical Course |

## 1. Course Summary

The aim of this course is to create a strong foundation of object-oriented programming principles and techniques using C++. The students are taught the basic principles of classes and objects. The students are also taught information hiding, data encapsulation and abstraction, inheritance, polymorphism, and built-in, user-defined, and derived data types. Students are trained to use constructors, destructors, and operator overloading features in the implementation of various programs. Students are trained to design and develop C++ programs using file store

## 2. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

**CO-1.** Describe the fundamentals of object-oriented programming [L-1]

**CO-2.** Explain different arithmetic and logical operations on different data types using control structures [L-2]

**CO-3.** Demonstrate the usage of classes, objects, constructors, destructors, and operator overloading [L-3]

**CO-4.** Experiment with a bottom-up approach using suitable C++ programs for different applications [L-4]

**CO-5.** Recommend file-manipulating operations for large data using C++ programs [L-5]

**CO-6.** Design and develop C++ programs using generic class and function templates and handle exceptions [L-6]

## 3. Course Contents

| Sr. No | Units |
|---|---|
| 1 | **Unit 1: Introduction to OOP**<br>• Introduction to data abstraction, encapsulation, polymorphism<br>• C++ program: Structure and Hello World Example<br>• Discussion on C++ keywords and Header Files |
| 2 | **Unit 2: Sublime Editor and Cygwin Compiler**<br>• Introduction to sublime editor<br>• Different menus and settings in sublime<br>• Installation of Cygwin and introduction to GCC |

| 3 | Unit 3: List of Experiments |
|---|---|
| 1 | Write a C++ Program to display the employee's name, ID, and salary details. |
| 2 | Write a C++ program to read a number and display each digit of a number in words. |
| 3 | Write a C++ program to sort a list of numbers in ascending order. |
| 4 | Create a structure STUDENT with fields ROLLNO, NAME, and MARKS. Display the student with the highest marks out of 'n' records. |
| 5 | Print the address and data for an integer, float number, and character using pointers. Determine the size of each data type. |
| 6 | Write a C++ program using functions to<br>   a) Find the largest of three numbers<br>   b) And for counting characters, white and spaces, and digits in a given string. |
| 7 | Design EMPLOYEE class contains the following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary. Write member function read () and print () to enter the data and display the employee records. |
| 8 | Create a class TEACHER with data members' salary and experience. Implement the following:<br>   a) Initialize using parametrized constructors<br>   b) Illustrate the use of the default constructor |
| 9 | Create two objects for a class timer. Assume three data members' hours, minutes, and seconds. Use two constructors for initializing the objects. Add two-time objects using operator overloading. Display appropriate values of hours, minutes, and seconds after addition. |
| 10 | Consider a base class EMPLOYEE and MANAGER as derived classes. Use name and ID as base class members. Inherit the members of the base class and display the MANAGER class with the salary as an additional data member. |
| 11 | Write a C++ program to demonstrate the use of new and delete operators for memory allocation and deallocation. |
| 12 | Store a list of integers in a file. Check whether the number is ODD or EVEN. Send the odd numbers to the ODD.dat file and even numbers to the EVEN.dat file. |
| 13 | Create a vector for storing a list of integers using the STL |
| 14 | Illustrate the exception for divide overflow error for any mathematical expression |

## 4. Course Articulation Matrix (CO-PO-PSO Map)

| | Programme Outcomes (POs) | | | | | | | | | | | | Programme Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 | PSO-1 | PSO-2 | PSO-3 |
| CO-1 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 |
| CO-2 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO-3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO-4 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO-5 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO-6 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| | 3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution | | | | | | | | | | | | | | |

## 5. Course Resources
   a.   **Essential Reading**

1. E. Balagurusamy, 2011, Object Oriented Programming with C++, 4$^{th}$ Edition, Tata McGraw Education Hill.
2. Herbert Schildt, 2003, The Complete Reference C++, 4$^{th}$ Edition, Tata McGraw Hill

**b. Recommended Reading**

1. Robert Lafore, 2008, Object-oriented Programming with C++, 4$^{th}$ edition, Pearson Education, India.
2. Stephen Prata, C++ Primer Plus: Teach Yourself Object Oriented Programming, 2$^{nd}$ edition, waite group

**c. Magazines and Journals**

1. C/C++ User Journal, CMP Media, Inc. P.O. Box 56565 Boulder, CO United States

**d. Websites**

1. https://www.udemy.com/topic/c-plus-plus/free/
2. https://archive.nptel.ac.in/courses/106/105/106105151/

**e. Other Electronic Resources**

1. https://ocw.mit.edu/courses/6-096-introduction-to-c-january-iap-2011/pages/lecture-notes/
2. https://cplusplus.com/doc/tutorial/