COMPUTER PROGRAMMING

Course Code	:	*CS 3001(Same as IT 3001)
Course Title	:	Computer Programming
Number of Credits	:	4 (L: 4; T: 0; P: 0)
Prerequisites	:	-
Course Category	:	PC

COURSE OBJECTIVES

To enable student, develop structured solutions to problems and implementing them using computers. This involves two parts: i)Formulating a solution for a given problem as a well-defined sequence of actions, and ii) Expressing solution in a machine-readable form or a programming language. For the second part, we will learn the common units of programming languages. The first part can only be learned through the repeated practice of solving problems.

COURSE OUTCOMES

Student should be able to computationally formulate basic problems and write code snippets to execute them. The focus of the course as mentioned above should be on example-based learning. The basic nitty gritties can be skipped, however, the application part should be clear. For instance, when to use an array, when to use loop and when to use conditional statements.

COURSE CONTENTS

The language of choice will be C. The focus will be on problem solving and problem where these ideas can be applied. The main focus of the class will to take examples of problems where these ideas can be employed.

1. **Introduction to Problem Solving**
   - 1.1. Computational way of thinking
   - 1.2. Variables
   - 1.3. Representation
2. **Operators and Formatting**
   - 2.1. Introduction to Operators
     - 2.1.1. Arithmetic Operators
     - 2.1.2. Relational Operators
     - 2.1.3. Logical and Bitwise Operators
   - 2.2. Input, Output, Formatting and File I/O
3. **Control Statements**
   - 3.1. Conditional Statements
   - 3.2. Repeat Statements
     - 3.2.1. Loops
     - 3.2.2. Nested Loops
4. **Arrays**
   - 4.1. Arrays and Memory Organization
   - 4.2. Strings
   - 4.3. Multidimensional Arrays
   - 4.4. Functions and Parameter Passing
5. **Recursion**
   - 5.1. Introduction to Recursion
   - 5.2. Recursive solutions

REFERENCE BOOKS:

1. Let Us C, Yashavant Kanetkar
2. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House
3. C Programming Absolute Beginner's Guide, Dean Miller and Greg Perry
4. The C Programming Language, Kernighan and Ritchie, Prentice Hall of India
5. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill
6. C Programming & Data Structures, B. A. Fouruzan and R. F. Gilberg, CENGAGE Learning.
7. Outline of Programming with C, Byron Gottfried, Schaum, McGraw-Hill

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SCRIPTING LANGUAGE (PYTHON)

Course Code	:	CS 3002
Course Title	:	Scripting Languages (Python)
Number of Credits	:	4(L: 4, T: 0, P:0)
Prerequisites	:	-
Course Category	:	PC

COURSE OBJECTIVES

To learn how to work with a scripting language.

COURSE OUTCOMES

At the end of the course student will be able to build program with a scripting language and will be able to learn any other scripting language on their own.

COURSE CONTENTS

UNIT 1: Introduction, Variables and Data Types

1.1 History
1.2 Features
1.3 Setting up path
1.4 Installation and Working with Python/Perl
1.5 Basic Syntax
1.6 Understanding Python variables
1.7 Numeric data types
1.8 Using string data type and string operations
1.9 Basic Operators
1.10 Understanding coding blocks
1.11 Defining list andlist slicing
1.12 Other Data Types (Tuples, List, Dictionary -Python, Arrays, Associative Arrays)

UNIT 2: Control Structures

2.1 Conditional blocks using if
2.2 else and elif
2.3 For loops and iterations
2.4 while loops
2.5 Loop manipulation using continue, break and pass
2.6 Programming using conditional and loops block

UNIT 3: Functions, Modules and Packages

3.1 Organizing codes using functions
3.2 Organizing projects into modules
3.3 Importing own module as well as external modules
3.4 Understanding Packages

UNIT 4: File I/O, Text Processing, Regular Expressions

4.1 Understanding read functions
4.2 Understanding write functions
4.3 Programming using file operations
4.4 Powerful pattern matching and searching
4.5 Power of pattern searching using regex

UNIT 5: Frameworks

5.1 Overview of Django
5.2 Django Design Philosophy
5.3 Creating a simple Django Project
5.4 Django App life cycle

REFERENCE BOOKS:

1. Taming Python by Programming, Jeeva Jose, Khanna Publishing House
2. Starting Out with Python, Tony Gaddis, Pearson
3. Core Python Programming, Wesley J. Chun, Prentice Hall
4. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University
5. Introduction to Computation and Programming Using Python. John V. Guttag, MIT Press.

6. Beginning Python using Python 2.6 and Python 3, James Payne,Wrox publishing
7. Practical Programming: An Introduction to Computer Science using Python3, Paul Gries, The Pragmatic Bookshelf

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DATA STRUCTURES

Course Code	:	*CS 3003(Same as IT 3003)
Course Title	:	Data Structures
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	-
Course Category	:	PC

COURSE OBJECTIVES

To provide strong foundation for implementing programming language to formulate, analyze and develop solutions related to various data structures problems.

COURSE OUTCOMES

Have a good understanding of Data Structures and its applications in algorithms.

COURSE CONTENTS

1. Introduction to Data Structures
- 1.1. Basic Terminology
- 1.2. Classification of Data Structures
- 1.3. Operations on Data Structures.

2. Linear Data Structures
- 2.1. Stacks
  - 2.1.1. Introduction to Stacks
  - 2.1.2. Array Representation of Stacks
  - 2.1.3. Operations on a Stack
  - 2.1.4. Applications of Stacks
    - 2.1.4.1. Infix-to-Postfix Transformation
    - 2.1.4.2. Evaluating Postfix Expressions.
- 2.2. Queues
  - 2.2.1. Introduction to Queues
  - 2.2.2. Array Representation of Queues
  - 2.2.3. Operations on a Queue
  - 2.2.4. Types of Queues
    - 2.2.4.1. DeQueue
    - 2.2.4.2. Circular Queue
  - 2.2.5. Applications of Queues-Round Robin Algorithm.

3. Linked Lists
- 3.1. Introduction to Linked List
  - 3.1.1. Singly Linked List
    - 3.1.1.1. Representation in Memory
    - 3.1.1.2. Operations on a Single Linked List
- 3.2. Circular Linked Lists
- 3.3. Doubly Linked Lists
- 3.4. Linked List Representation and Operations of Stack
- 3.5. Linked List Representation and Operations of Queue.

4. Non Linear Data Structures
- 4.1. TREES
  - 4.1.1. Basic Terminologies
  - 4.1.2. Definition and Concepts of Binary Trees
  - 4.1.3. Representations of a Binary Tree using Arrays and Linked Lists
  - 4.1.4. Operations on a Binary Tree
    - 4.1.4.1. Insertion
    - 4.1.4.2. Deletion
    - 4.1.4.3. Traversals
  - 4.1.5. Types of Binary Trees.
- 4.2. GRAPHS
  - 4.2.1. Graph Terminologies
  - 4.2.2. Representation of Graphs
    - 4.2.2.1. Set
    - 4.2.2.2. Linked
    - 4.2.2.3. Matrix

4.2.3. Graph Traversals

REFERENCE BOOKS:

1. Data Structures, R.S. Salaria, Khanna Book Publishing, NewDelhi
2. Data Structures Using C, ReemaThareja, Oxford University Press India.
3. Classic Data Structures, SamantaDebasis, Prentice Hall ofIndia.
4. Fundamentals of Data Structure in C, Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, University Press, India.
5. Data Structures: A Pseudo code approach with C, Richard F. Gilberg, Behrouz A. Forouzan, CENGAGE Learning, India.
6. Data Structures and Algorithms: Concepts, Techniques and Applications, G.A.V. Pai, McGraw- Hill Education, India.

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COMPUTER SYSTEM ORGANISATION

Course Code	:	CS 3004
Course Title	:	Computer System Organisation
Number of Credits	:	4(L: 3, T: 1, P: 0)
Prerequisites	:	-
Course Category	:	PC

COURSE OBJECTIVES

To have a thorough understanding of the basic structure and operation of a digital computer, its architectures and computational designs.

COURSE OUTCOMES

Have a good understanding of functioning of computer system as such and its various sub components. Student will be able to underst and computing requirement for a specific purpose, analyse performance bottlenecks of the computing device and choose appropriate computing device for a given usecase.

COURSE CONTENTS

1. Structure of Computers

- 1.1. Computer Functional units
- 1.2. Von-Neumann architecture
- 1.3. Bus structures
- 1.4. Basic Operational Concepts
- 1.5. Data representation (Fixed and Floating point)
- 1.6. Error detecting codes.
- 1.7. Register Transfer and Micro Operations
  - 1.7.1. Register transfer
  - 1.7.2. Bus and memory transfers
  - 1.7.3. Arithmetic micro-operations
  - 1.7.4. Logic micro-operations
  - 1.7.5. Shift micro-operations
  - 1.7.6. Arithmetic logic shift unit.

2. Micro Programmed Control

- 2.1. Control memory
- 2.2. Address sequencing
- 2.3. Design of control unit
- 2.4. Computer Arithmetic
  - 2.4.1. Addition and Subtraction
  - 2.4.2. Multiplication and Division algorithms
  - 2.4.3. Floating-point arithmetic operation
  - 2.4.4. Arithmetic Pipeline
  - 2.4.5. Instruction Pipeline
  - 2.4.6. RISC Pipeline
  - 2.4.7. Vector Processing
  - 2.4.8. Array Processors.

3. Introduction to Microprocessor Architecture

- 3.1. Instruction Set Architecture design principles fromprogrammer's perspective.
- 3.2. One example microprocessor (Intel, ARM, etc).

4. AssemblyLanguageProgramming

- 4.1. Simpleprograms
- 4.2. Assemblylanguageprogramsinvolving
  - 4.2.1. logical
  - 4.2.2. branch
  - 4.2.3. call instructions
  - 4.2.4. sorting
  - 4.2.5. evaluation of arithmetic expressions

4.2.6. string manipulation
4.2.7. assembler directives
4.2.8. procedures andmacros.

5. Memory and Digital Interfacing

5.1. addressing and address decoding
5.2. Interfacing of:
5.2.1. RAM
5.2.2. ROM
5.2.3. EPROM

REFERENCE BOOKS:

1. Computer System Architecture, M. Moris Mano, Pearson/PHI India.
2. Microprocessors Interface, Douglas V.Hall, Tata McGraw-Hill.
3. Computer Organization, Carl Hamacher, Zvonks Vranesic, Safea Zaky, McGraw-Hill
4. Advanced Microprocessors and Peripherals- Architecture, Programming and interfacing, A.K.Ray, K.M. Bhurchandi, Tata McGraw-Hill, New Delhi, India.
5. Computer Organization and Design: A Hardwar/Software Interface (MIPS Edition) by Patterson and Hennessy.

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ALGORITHMS

Course Code	*CS 3005(Same as IT 3005)
Course Title	Algorithms
Number of Credits	4(L: 3, T: 1, P: 0)
Prerequisites	-
Course Category	PC

COURSE OBJECTIVES

The objective of this course is to prepare the student with the algorithmic foundations of computing. A sound grasp of algorithms is essential for any computer science engineer. Almost all programming involves algorithms at some level.

COURSE OUTCOMES

The student should be able to design basic algorithms for sorting and searching. The student should be able to understand the basic notions of time and space complexity of algorithms. The student should be able to implement sorting, searching, tree and graph algorithms in a modern computer programming language.

COURSE CONTENTS

1. Fundamentals
- 1.1. Programming Models
- 1.2. Data Abstraction
  - 1.2.1. Sets
  - 1.2.2. Multisets
  - 1.2.3. Stacks
  - 1.2.4. Queues
- 1.3. Asymptotic and worst-case analysis of algorithms.

2. Sorting
- 2.1. The sorting problem
- 2.2. Bubble sort
- 2.3. Selection sort
- 2.4. Insertion sort
- 2.5. Merge sort
- 2.6. Quicksort.

3. Searching
- 3.1. Symbol Tables
- 3.2. Binary Search Trees
- 3.3. Balanced Search Trees
- 3.4. Hash Tables.

4. Graphs
- 4.1. Definition of a directed and undirected graph
  - 4.1.1. Paths
  - 4.1.2. Cycles
  - 4.1.3. Spanning trees
- 4.2. Directed Acyclic Graphs
- 4.3. Topological Sorting
- 4.4. Minimum Spanning Tree algorithms
  - 4.4.1. Shortest Path algorithms: Dijkstra's algorithm
  - 4.4.2. Flow-based algorithms.

5. Strings
- 5.1. String Sort
- 5.2. Tries
- 5.3. Substring Search
- 5.4. Regular Expressions
- 5.5. Elementary Data compression.

REFERENCE BOOKS:

1. Algorithms, Sedgewick and Wayne, Pearson
2. Introduction to Algorithms, Cormen, Leiserson, Rivest and Stein. MIT Press

3. Introduction to Theory of Computation, Sipser Michael, Cengage Learnng.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House

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COMPUTER PROGRAMMING LAB

Course Code	*CS 3006(Same as IT 3006)
Course Title	Computer Programming Lab
Number of Credits	2(L: 0, T: 0, P: 4)
Prerequisites	-
Course Category	PC

COURSE OBJECTIVES

This Lab course is intended to practice what is taught in theory class of 'ComputerProgramming' and become proficient in computer programming. Computer programming is all about regular practice. Students should work on solved and unsolved problems listed in the text books, and the problems given by the teacher. Some of the topics that should necessary be covered in lab are listedbelow.

COURSE OUTCOMES

Student should be able to write code snippets, and then compile, debug and execute them.

COURSE CONTENTS

S.No.	Topics for Practice
1	Familiarization with programming environment (Editor, Compiler, etc.)
2	Programs using I/O statements and various operators
3	Programs using expression evaluation and precedence
4	Programs using decision making statements and branching statements
5	Programs using loop statements
6	Programs to demonstrate applications of n dimensional arrays
7	Programs to demonstrate use of string manipulation functions
8	Programs to demonstrate parameter passing mechanism
9	Programs to demonstrate recursion
10	Programs to demonstrate use of pointers
11	Programs to demonstrate command line arguments
12	Programs to demonstrate dynamic memory allocation
13	Programs to demonstrate file operations

The language of choice will be C. This is a skill course. More you practice, better it will be.

REFERENCE BOOKS:

1. Let Us C, Yashavant Kanetkar
2. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House
3. C Programming Absolute Beginner's Guide, Dean Miller and GregPerry
4. The C Programming Language, Kernighan and Ritchie, Prentice Hall of India
5. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill
6. C Programming & Data Structures, B. A. Fouruzan and R. F. Gilberg, CENGAGE Learning.

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SCRIPTING LANGUAGE (Python) LAB

Course Code	CS 3007
Course Title	Scripting Language (Python)Lab
Number of Credits	2(L: 0, T: 0, P: 4)
Prerequisites	-
Course Category	PC

COURSE OBJECTIVES

This Lab course is intended to practice whatever is taught in theory class of 'Scripting Languages' and become proficient in scripting. Computer programming is all about regular practice. Students should work on solved and unsolved problems listed in the text books, and the problems given by the teacher. Some of the topics that should necessary be covered in lab are listedbelow.

COURSE OUTCOMES

At the end of the course student will be able to build program with a scripting language and will be able to learn any other scripting language on their own.

COURSE CONTENTS

S.No.	Topics for Practice
1	Practice basic coding syntax
2	Write and execute scripts based on data types
3	Write and execute Python scripts with conditionals and loops
4	Write and execute Scripts based on Functions and Modules
5	File Processing scripts
6	Write and execute Regular Expressions
7	Write and execute SQL Queries

Lecturer may choose any one scripting language. This is a skill course. More student practice and try to find solution on their own, better it will be.

REFERENCE BOOKS:

1. Taming Python by Programming, Jeeva Jose, Khanna PublishingHouse
2. Starting Out with Python, Tony Gaddis, Pearson
3. Core Python Programming, Wesley J. Chun, Prentice Hall
4. Python Programming: Using Problem Solving Approach, Reema Thareja,Oxford University Press
5. Introduction to Computation and Programming Using Python. John V. Guttag, MITPress.
6. Beginning Python using Python 2.6 and Python 3, James Payne, Wrox publishing
7. Practical Programming: An Introduction to Computer Science using Python3, Paul Gries, The Pragmatic Bookshelf

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DATA STRUCTURES LAB

Course Code	*CS 3008(Same as IT 3008)
Course Title	Data Structures Lab
Number of Credits	1(L: 0, T: 0, P: 2)
Prerequisites	-
Course Category	PC

COURSE OBJECTIVES

This Lab course is intended to practice whatever is taught in theory class of 'Data Structures', 'Algorithms' and is an extension of previous course on 'Computer Programming'. Students should work on problems listed in the text books, and the problems given by the teacher. Some of the topics that should necessary be covered in lab are listed below. This Lab course requires a good coordination between theory course in Data Structures and Algorithms.

COURSE OUTCOMES

Student will be able to write programs for creating and doing different operations on various data structures. Student will be able to use/implement various algorithms learnt in the course on Algorithms. In summary student will have a good command over Data Structures and its applications in Algorithms.

COURSE CONTENTS

S.No.	Topics for Practice
1	Write a program using recursive and non-recursive functions to perform search operation in a given list of integers using linear search technique
2	Search operation in a given list of integers using binary search technique
3	Write a program to implement insertion sorting for a given random data
4	Write a program to implement bubble sorting for a given random data
5	Write a program to implement quick sorting for a given random data
6	Write a program to implement selection sorting for a given random data
7	Write a program to implement heap sorting for a given random data
8	Write a program to implement single linked list
9	Write a program to implement double linked list
10	Write a program to implement circular linked list
11	Write a program to Implement Stack operations using array and linked list
12	Write a program to Implement Queue operations using array and linked list.
13	Write a program to implement Breadth First Search (BFS)
14	Write a program to implement Depth First Search (DFS)
15	Write a program to implement a binary tree of integers

Use'C' as programming language for the purpose. This is a skill course. More student practice and try to find solution on their own, better it will be.

REFERENCE BOOKS:

1. Data Structures, R.S. Salaria, Khanna Book Publishing
2. Data Structures Using C, ReemaThareja, Oxford University Press India.
3. Classic Data Structures, SamantaDebasis, Prentice Hall ofIndia.
4. Fundamentals of Data Structure in C, Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, University Press,India.
5. Data Structures: A Pseudo code approach with C, Richard F. Gilberg, Behrouz A. Forouzan, CENGAGE Learning, India.
6. Data Structures and Algorithms: Concepts, Techniques and Applications, G.A.V. Pai, McGraw- Hill Education, India.

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