## Semester III

| Sl. No. | Category | Course Code | Course Title | L | T | P | Contact Hours/ week | Credit |
|---|---|---|---|---|---|---|---|---|
| 1. | Essential Subject-1 | ES-301 | Database Management System | 3 | 0 | 0 | 3 | 3 |
| 2. | Essential Subject-2 | ES-302 | Computer System Organization | 3 | 0 | 0 | 3 | 3 |
| 3. | Essential Subject-3 | ES-303 | Python | 3 | 0 | 0 | 3 | 3 |
| 4. | Programme core Course-4 | AIPC304 | Fundamentals Of Artificial Intelligence | 2 | 0 | 0 | 2 | 2 |
| 5. | Essential Subject-4 | ES-305 | Data Structure And Algorithm | 2 | 0 | 0 | 2 | 2 |
| 6. | Programme core Course-5 | AIPC-306 | Database Management System Lab | 0 | 0 | 4 | 4 | 2 |
| 7. | Programme core Course-6 | AIPC-307 | Artificial Intelligence Lab | 0 | 0 | 4 | 4 | 2 |
| 8. | Programme core Course-7 | AIPC-308 | Python Lab | 0 | 0 | 2 | 2 | 1 |
| 9. | Programme core Course-8 | AIPC-309 | Data Structure And Algorithm Lab | 0 | 0 | 2 | 2 | 1 |
| 10. | Summer Internship-I(4 weeks) after II nd semester) | AISI-310 | Summer Internship-I | 0 | 0 | 0 | 0 | 2 |
| Total : | | | | | | | | 21 |

**Database Management System**

| | |
|---|---|
| Course Code | ES-301 |
| Course Title | Database Management System |
| Number of Credits | 3 (L: 3, T: 0, P: 0) |
| Prerequisites | - |
| Course Category | Essential Subject-1 |

**Course Outcomes: -**Upon completion of the course the students will be able to: 1)Describe the requirements and applications of DBMS **(K2)**

- Utilize ER and EER model**(K3)**
- Apply relational algebra and calculus**(K3)**
- Develop SQL programs **(K4)**
- Utilize Normalization techniques and relational database designalgorithms Architecture **(K3)**

**Course Content:-**

**Module-1:**

**Introduction to DBMS** Number of class Hours: 3-4 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Define DBMS
- List the requirements of DBMS
- Describe the applications of DBMS

Detailed content of the unit: - Introduction; Database System Concepts and Architecture.

**Module-2:**

**ER model and EER model**

Number of class Hours: 3-4 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Explain data modelling using ER and EER model
- Utilize ER model
- Utilize EER model

Detailed content of the unit: - Data Modeling using the Entity-Relationship Model; TheEnhanced Entity-Relationship (EER) model.

**Module-3: Relational Data model, Relational Algebra and Calculus**

Number of class hours: 8-10 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Explain relational data model and relational database constraints
- Demonstrate ER/EER to Relational Model mapping
- Apply relational algebra and relational calculus

Detailed content of the unit: - The Relational Data Model and Relational Database Constraints; ER/EER to Relational Model mapping; Relational Algebra and Relational Calculus.

**Module-4: SQL**

Number of class hours: 10-12 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Define schema, constraints, queries and views etc.
- Categorize DDL, DML etc.
- Develop SQL programs

Detailed content of the unit: SQL-99: Schema definition, Constraints, Queries, and Views; Security; Introduction to SQL programming Techniques.

**Module5:**

**Normalization**

Suggestive Learning Outcomes: After completing this module students will be able to-

- Explain functional dependencies
- Normalize relational database tables

- Utilize relational database design algorithms and further dependencies

Detailed content of the unit: - Functional dependencies and normalization for relational databases; Relational database design algorithms and further dependencies.

**References:** -


- Fundamentals of Database Systems, Elmasri&Navathe, Pearson Education
- Database Management Systems, Raghurama Krishnan, Johannes Gehrke, TataMcGraw-Hill.
- Database System Concepts, Abraham Silberschatz, Henry F. Korth, S.Sudarshan, McGraw-Hill, New Delhi, India.
- Introduction to Database Systems, C.J.Date, Pearson Education
  Introduction to SQL, Rick F.VanderLans, Pearson Education


## Computer System Organization

| | |
|---|---|
| Course Code | ES-302 |
| Course Title | Computer System organization |
| Number of Credits | 3( L: 3, T:0, P:0) |
| Prerequisites | Knowledge of Number System |
| Course Category | Essential Subject-2 |

**Course Outcomes**: -

After Completion of the course students will be able to:

- Have a thorough understanding of functioning of digital computer system as such and its various subcomponents.
- Understand computing requirement for a specific purpose
- Analyse performance bottlenecks of the computing device
- Choose appropriate computing device for a given use case.

**Detailed Course Contents**

**Module- 1: Introduction to Computer System**

**Suggestive Learning Outcomes:**

- Identify and explain functionality of various parts of digital computer
- Illustrate data representation.
- Explain register and arithmetic micro operation.

**Detailed content of the unit:**

- Structure of Computers: Computer Functional units, Von-Neumann architecture, Bus Structures.
- Basic Operational Concepts, Data representation (Fixed and Floating point)
- Error detecting codes.
- Register Transfer and Micro Operations: Register transfer, Bus and memory transfers.
- Basics of Arithmetic micro-operations, Logic micro-operations, Shift micro-operations, and Arithmetic logic shift unit.

**Module- 2: Micro Programmed Control and Pipeline**

Number of class hours: 8

**Suggestive Learning Outcomes**:

- Explain working of Control unit.
- Solve arithmetic problems
- Understand concept of pipelining

**Detailed content of the unit:**

- Micro Programmed Control: Control memory, Address sequencing, and design of control unit
- Computer Arithmetic: Addition and Subtraction, Multiplication and Division algorithms, Floating-point arithmetic operation
- Introduction to Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors

**Module-3: Microprocessor**

Number of class hours: 6

**Suggestive Learning Outcomes:**

- Understand and learn various parts of microprocessor
- Recognize and apply various instructions .

**Detailed content of the unit**:

- Introduction to Micro proccessor Architecture
- Instruction Set Architecture design principles from programmer's perspective. One example microprocessor (Intel, ARM, etc).

**Module-4: Programming the Basic Computer**
**Number of class hours:5 hrs**

**Suggestive Learning Outcomes:**

- Write simple assembly level programs
- Understand and explain procedure and macros
- Evaluate arithmatic expression

**Detailed content of the unit**:

- Assembly Language Programming: Simple programs, Assembly language programs involving logical, branch and call instructions
- Sorting, evaluation of arithmetic expressions
- String manipulation, assembler directives
- Procedures and macros.

**Module- 5: Memory and I/O Organization**
**Number of class hours:5 hrs**

**Suggestive Learning Outcomes:**

- Understand and illustrate memory and I/O interfacing
- Demonstarte various modes of I/O operation

**Detailed content of the unit:**

- Memory and Digital Interfacing: addressing and address decoding
- Interfacing RAM, ROM, EPROM, programmable peripheral interface

- Various modes of operation and interfacing to processor, interfacing keyboard, displays etc.

**References:**


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


## PYTHON

| | |
|---|---|
| Course Code | ES-303 |
| Course Title | Python |
| Number of Credits | 2 (L: 2, T: 0, P: 0) |
| Prerequisites | Knowledge of Programming |
| Course Category | Essential Subject-3 |

**Course Outcomes: -**

- After the completion of the course Student will be able to
- Draw flow charts for solving different problems, develop efficient algorithms for solvinga problem. (**K3**)
- Use the various constructs of Python viz. conditional, iteration(**K1**)
- Write programs making judicious use of Lists, Strings, Tuples, Dictionaries whereverrequired(**K3)**
- Manage data using NumPy (**K3**)
- Handle files and Modules in Python (**K2)**

**Course Content:-**

**Module- 1: Introduction to Programming, Algorithm and Flowcharts**

Number of class hours: 04 Hrs

Suggestive Learning Outcomes:

- Understand the concept and evolution of Programming. **(K1)**
- Understand the concepts and purposes of algorithm and flowchart. **(K1)**
- Use algorithm and flowchart to solve problem independent of language. **(K3)**
- Gain knowledge of different constructs of algorithm and flowchart. **(K2)**

- Detailed content of the unit: - The basic Model of computation, Algorithms, Flowcharts, Programming Languages, Compilation, Testing & debugging and documentation, Flow Chart Symbols, Basic algorithms/flowcharts for sequential processing, Decision based processing and Iterative processing.

## Module- 2: Introduction to Python

Number of class hours: 05 Hrs

- Suggestive Learning Outcomes:
- Understand features of Python that make it one the most popular languages in theindustry. **(K1)**
- Understand structure of Python problem. **(K2)**
- Understand the areas where Python is used. **(K2)**

- Detailed content of the unit: - Python Introduction, Technical Strength of Python, Introduction to Python Interpreter and program execution, Using Comments, Literals, Constants, Python's Built- in Data types, Numbers (Integers, Floats, Complex Numbers, Real, Sets), Strings (Slicing, Indexing, Concatenation, other operations on Strings), Accepting input from Console, printing statements, Simple 'Python' programs.

## Module- 3: Operators, Expressions and Python Statements, Sequence data types

Number of class hours: 8 Hrs

Suggestive Learning Outcomes:

- Use the basic operators and expressions available in Python in developing program. **(K3)**
- Understand and use various Python statements like conditional constructs, looping constructs in writing Python program. **(K3)**
- Work with various built-in Sequence datatypes and their use. **(K3)**
- Understand the concept of mutable and immutable objects. **(K2)**

- Detailed content of the unit: - Assignment statement, expressions, Arithmetic, Relational, Logical, Bitwise operators and their precedence, Conditional statements: if, if-else, if-elseif- else; simple programs, Notion of iterative computation and control flow –range function, While Statement, For loop, break statement, Continue Statement, Pass statement, else, assert.
- Sequence Data Types: Lists, tuples and dictionary, (Slicing, Indexing, Concatenation, other operations on Sequence datatype), concept of mutability, Examples to include finding the maximum, minimum, mean; linear search on list/tuple of numbers, and counting the frequency of elements in a list using a dictionary.

**Module- 4: Functions ,File Processing ,Modules**
**Number of class hours:8 hrs**

Suggestive Learning Outcomes:

- Apply the in-built functions available in Python in solving different problems. **(K3)**
- Work with modular approach using user defined functions. **(K2)**
- Work with files and reading /writing onto files. **(K3)**
- Understand the concept of modules and importing, loading and reloading of modules inprograms. **(K1)**

- Detailed content of the unit: - Functions Top-down approach of problem solving, Modular programming and functions, Function parameters, Local variables, the Return statement, DocStrings, Global statement, Default argument values, Keyword arguments, VarArgs parameters. Library functions, Time functions,

Recursion, Concept of Files, File opening in various modes and closing of a file, Reading from a file, Writing onto a file, File functions, Command Line arguments, Scope of objects and Names, LEGB Rule, Module Basics, Module Files as Namespaces, Import Model, Reloading Modules.

**Module-5:**
**NumPy Basics**

Number of class
hours: 05 Hrs

Suggestive Learning Outcomes:

- Work on NumPy array manipulation to access data and subarrays and to split, reshape,join arrays etc. **(K3)**

- Detailed content of the unit: - Introduction to NumPy, ndarray, datatypes, array attributes, array creation routines, Array from Existing Data, Array from Numerical Ranges, Indexing & Slicing.

**References:** -


- Python Programming- A modular Approach (with Graphics, database, Mobile and Web Applications by Sheetal Taneja and Naveen Kumar, Pearson.
- Head First Python by Paul Berry, O'Reilly
- Dive into Python by Mark Pilgrim, APress
- Beginning Programming with Python Dummies by John Paul Meuller.
- Programming and Problem Solving Through Python Language, Prof. Satish Jain, ShashiSingh, BPB Publication.

# Fundamentals Of Artificial Intelligence

| | |
|---|---|
| Course Code | AIPC-304 |
| Course Title | Fundamentals Of Artificial Intelligence |
| Number of Credits | 3 (L: 3, T: 0, P: 0) |
| Prerequisites | Data Structure & Algorithm, Mathematics, Basic Programming |
| Course Category | Program Core Course-4 |
| Number of classes | 38 hours |

**Course Outcomes: -**

1. The biological foundations to intelligent systems and searching.
2. knowledge representation and implement logic programming.
3. fundamentals of experts systems
4. Formulate reasoning under uncertainty.

**Course Content:-**

**Module- 1: Introduction**

Number of class hours: 05 Hrs

Concept of AI, history, current status, Defining the Problem as a State Space Search, Search: BFS, DFS; Heuristic Search Techniques: Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO*Algorithm, stochastic annealing, Minimax Search, Alpha-Beta Pruning.

Biological foundations to intelligent systems: Overview of different forms of learning, Learning Decision Trees, Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks. Fuzzy logic, Genetic algorithm, and fuzzy neural networks.

**Module 2: Biological Foundation**

Number of class hours: 05 Hrs

Biological foundations to intelligent systems: Overview of different forms of learning, Learning Decision Trees, Artificial neural

networks, Back-propagation networks, Radial basis function networks, and recurrent networks. Fuzzy logic, Genetic algorithm, and fuzzy neural networks.

## Module 3: Knowledge representation

Number of class hours: 10 Hrs

Knowledge representation and logical inference Issues in knowledge representation, Knowledge-based systems structures, and its components. Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Syntax and Semantics of FOPL, Normal Forms, Unification and Resolution, Representation Using Rules, Natural Deduction; Structured Representations of Knowledge: Semantic Nets, Frames, Conceptual Dependency, Scripts.

## Module 4:Expert System

Number of class hours: 08 Hrs

Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells, Fuzzy Expert systems.

## Module 5: Knowledge and Reasoning

Number of class hours: 10 Hrs

Uncertain Knowledge and Reasoning, Probabilities, Reasoning under uncertainty: Probabilistic reasoning, belief networks, hidden Markov model.

Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences and Fuzzy Systems.

**REFERENCES**


- Artificial Intelligence, George F Luger, Pearson Education Publications
- Artificial Intelligence, Elaine Rich and Knight, Mcgraw-Hill Publications
- Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
- Multi Agent systems- a modern approach to Distributed Artificial intelligence, Weiss. G,MIT Press.
- Artificial Intelligence : A modern Approach, Russell and Norvig, Printice Hall


## DATA STRUCTURES & ALGORITHMS

| | |
|---|---|
| Course Code | ES-305 |
| Course Title | Data Structures & Algorithms |
| Number of Credits | 3 (L:3, T:0, P:0) |
| Prerequisites | - |
| Course Category | Essential Subject-4 |

**Course Outcomes: -**Upon completion of the course the students will be able to:1)Classify Data structures **(K2)**

- Describe Linear Data Structures **(K2)**
- Explain Non-Linear Data Structures**(K2)**
- Explain basic algorithmic concepts and recursion **(K2)**
- Apply different Sorting and Searching Algorithms**(K3)**

**Course Content:-**

**Module- 1: Introduction to Data Structures**

Number of class hours: 3 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Define Data Structures
- Classify Data Structures
- Describe operations on Data Structures
- Detailed content of the unit: - Basic Terminology, Classification of Data Structures, Operationson Data Structures

**Module-2:Linear Data Structures**

Number of class hours:12 Hrs

Suggestive Learning Outcomes: After completing this module students will be able to-

- Explain Arrays and operations on Arrays
- Illustrate Linked List and operations on Linked List
- Demonstrate Stack, Queue and related applications.

- Detailed content of the unit: -
    - Arrays: Introduction to Arrays, Representation in Memory, Operations on an Array, Two Dimensional Arrays

    - Linked Lists: Singly Linked List, Representation in Memory, Operations on a Single Linked List, Circular Linked Lists, Doubly Linked Lists.
    - Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked List Representation and Operations of Stack, Applications of Stacks-Infix-to-Postfix Transformation, evaluating Postfix Expressions.

    - Queues: Introduction to Queues, Array Representation of Queues, Operations on a Queue, Linked List Representation and Operations of Queue, Types of Queues-DeQueue, Circular Queue, Applications of Queues-Round Robin Algorithm

**Module-3:Non Linear Data Structures**

Number of class hours:6 Hrs

Suggestive Learning Outcomes: After completing this module students will be able to-

- Explain Tree
- Explain operations on Binary Tree
- Explain Graph and its various representations

- Detailed content of the unit: - Trees: Basic Terminologies, Definition and Concepts of Binary Trees, Representations of a Binary Tree using Arrays and Linked Lists, Operations on a Binary Tree-Insertion, Deletion, Traversals, Types of Binary Trees.
- Graphs: Graph Terminologies, Representation of Graphs- Set, List, Matrix, Graph Traversals.

**Module-4: Introduction to Algorithms**

Number of class hours: 3-5 Hours

- Suggestive Learning Outcomes: After completing this module students will be able to-
- Define Algorithms and Flowcharts
- Define Time & Space complexity
- Explain recursion with examples

- Detailed content of the unit: - Algorithms and flow charts, Time & Space complexity (definition only)
- Recursion: Basic concepts and examples of recursion e.g. factorial problem, Fibonacci sequence.

**Module-5:Sorting & Searching Algorithms**

Number of class hours: 7-10 Hours

Suggestive Learning Outcomes: After completing this module students will be able to-

- Apply various Sorting Algorithms
- Apply different Searching Algorithms

Detailed content of the unit: - Sorting Algorithms**:** Algorithms and their analysis (time and space) — Bubble sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and Radix Sort

Searching Algorithms**:** Linear search — Binary search –Concept of Hashing.

**References:** -


- Data Structures, R.S. Salaria, Khanna Book Publishing, New Delhi
- Data Structures Using C, Reema Thareja, Oxford University Press India.
- Classic Data Structures, SamantaDebasis, Prentice Hall of India.
- Fundamentals of Data Structure in C, Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, University Press, India.
- Data Structures: A Pseudo code approach with C, Richard F. Gilberg, Behrouz
- Forouzan, CENGAGE Learning, India.
- Data Structures and Algorithms: Concepts, Techniques and Applications, G.
  V. Pai, McGraw- Hill Education, India.
- Introduction to Algorithms, T.H. Cormen, C.E. Leiserson, R.
  L. Rivest, C.Stein, MIT


## Database Management System LAB

| | |
|---|---|
| Course Code | AIPC-306 |
| Course Title | Database Management System Lab |
| Number of Credits | 1 (L:0, T:0, P:2) |
| Prerequisites | - |
| Course Category | Programme core course-5 |

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

- Apply DDL commands to create a tableand insert data into it **(K3)**
- Utilize DML commands to modify database contents**(K3)**
- Implement Employee database**(K3)**
- Prepare E-R model, Relational model etc.**(K3)**
- Apply Normalization techniques**(K3)**

**Course Content:-**

| Sl No | Topics for practice |
|---|---|
| **1** | Case Study-1: Employee database – 'Create' employee table, 'Select' and display an employee matching a given condition, 'Delete' duplicate records, delete rows using triggers, insert and update records, find net salary, etc. |
| **2** | Case Study-2: Visitor Management database |
| **3** | Case Study-3: Students Academic database |
| **4** | Case Study-4: Inventory Management System database |
| **5** | Case study-5: Bank Operations database |
| **6** | Case Study-6: Bus Operator (Roadways) – Do related activities such as prepare E-R Model, Relational Model, do Normalization, Create Tables, Insert data, Delete Data, Query database, create stored procedures, etc |

**References:** -


- Elmasri&Navathe, Fundamentals of Database Systems, Pearson Education 2)Raghurama Krishnan, Johannes Gehrke, Database Management Systems, Tata
- McGraw-Hill,New Delhi, India.Computer Engineering Curriculum Structure344
- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw-Hill, New Delhi, India.
- Introduction to Database Systems, C.J.Date, Pearson Education
- Introduction to SQL, Rick F.VanderLans, Pearson Education


## Artificial Intelligence Lab

| | |
|---|---|
| Course Code | AIPC-307 |
| Course Title | Artificial Intelligence Lab |
| Number of Credits | 1 (L: 0, T: 0, P: 2) |
| Prerequisites | |
| Course Category | Programme Core Course-6 |
| Number of classes | 24 hours |

**Course Outcome:-**

- Solve basic AI based problems**.**
- Define the concept of Artificial Intelligence

• Apply AI techniques to real-world problems to develop intelligent systems.

**List of Experiments:-**

- Study of Prolog.
- Write simple fact for the statements using PROLOG.
- Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
- Write a program to solve the Monkey Banana problem.
- WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
- WAP to implement factorial, fibonacci of a given number.
- Write a program to solve 4-Queen problem.
- Write a program to solve traveling salesman problem.
- Write a program to solve water jug problem using LISP
- Implementation of DFS for water jug problem using LISP/PROLOG
- Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java
- Implementation of TSP using heuristic approach usingJava/LISP/Prolog
- Implementation of Simulated Annealing Algorithm using LISP/PROLOG
- Implementation of Hill-climbing to solve 8- PuzzleProblem
- Implementation of Towers of Honoi Problem using LISP/PROLOG
- Implementation of A* Algorithm using LISP/PROLOG
- Implementation of Hill Climbing Algorithm using LISP/PROLOG
- Implementation Expert System with forward chaining using JESS/CLIPS
- Implementation Expert System with backward chaining usingRVD/PROLOG

**Learning Websites:**

https://www.hpe.com/hpe/ai_solutions

https://www.coajs.org/

https://www.analyticsforliving.org/ai/machinelearning

# Python Lab

| | |
|---|---|
| Course Code | AIPC-308 |
| Course Title | Python Lab |
| Number of Credits | 1 (L: 0, T: 0, P: 2) |
| Prerequisites | ES 208(Programming for Problem Solving Lab) |
| Course Category | Program Core Course-7 |
| Number of classes | 24 hours |

**Course Outcome:-**

1. Develop algorithmic solutions to simple computational problems. K3
2. Demonstrate programs using Python control flow and functions. K3
3. Utilize Python datatypes for accessing different data. K3
4. Analyse and use different machine learning libraries using python.K4

**List of Experiments** (Minimum 6 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available)**:**

- Download & Install Python and introduction to Python Language, Python Language Syntax, python Keywords and Identifiers, python Comments and python Variables.
- Python Data Types, User Input, and Operators.
- Python Modules.
- Python Control Flow – Decision Making.
- Python Control Flow – Looping and Branching.
- Python Function.
- Python Numbers and Lists

- Python Tuples and Strings.
- Python Sets and Dictionaries.
- Python Arrays.
- Python OOPs Concepts, Classes and Object and Constructors.
- Python Inheritance and Polymorphism.
- Python Regular Expressions.
- Python Database Access.
- Python- Numpy, SciPy, Matplotlib.
- Python-Pandas.
- Python Scikit-learn.
- Python Scikit-image, PIL, Pillow etc.

**References / Suggested Learning Resources:-**


- John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hallof India.
- R. Nageswara Rao, "Core Python Programming", dreamtech.
- Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall
- Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley.
- Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.
- MySQL for Python, by Albert Lukaszewski, Packt Publishing.


## DATA STRUCTURES AND ALGORITHM LAB

| | |
|---|---|
| Course Code | AIPC-309 |
| Course Title | Data Structures And Algorithm Lab |
| Number of Credits | 1 (L:0, T:0, P:2) |
| Prerequisites | - |
| Course Category | Program core course -8 |

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

- Implement single and two dimensional array **(K3)**
- Develop programs to implement different search operations **(K3)**
- Implement sorting algorithms**(K3)**
- Implement different types of Linked List **(K3)**
- Utilize array and linked list to implement Stack and Queue**(K3)**
- Implement binary tree **(K3)**

## Course Content:-

| Sl No | Topics for practice |
|---|---|
| **1** | Write a program to implement array |
| **2** | Write a program to add two matrices using two dimensional arrays |
| **3** | Write a program using recursive and non-recursive functions to perform search<br>operation in a given list of integers using linear search technique |
| **4** | Write a program to implement search operation in a given list of integers using binary<br>search technique |
| **5** | Write a program to implement insertion sorting for a given random data |
| **6** | Write a program to implement bubble sorting for a given random data |
| **7** | Write a program to implement quick sorting for a given random data |
| **8** | Write a program to implement selection sorting for a given random data |
| **9** | Write a program to implement heap sorting for a given random data |
| **10** | Write a program to implement Hashing tables |
| **11** | Write a program to implement single linked list |
| **12** | Write a program to implement double linked list |
| **13** | Write a program to implement circular linked list |
| **14** | Write a program to Implement Stack operations using array and linked list |
| **15** | Write a program to Implement Queue operations using array and linked list. |
| **16** | Write a program to implement Breadth First Search (BFS) |
| **17** | Write a program to implement Depth First Search (DFS) |

| | |
|---|---|
| **18** | Write a program to implement a binary tree of integers |
| **19** | Write a program to find the minimum depth of a binary tree |

**Above programs may be developed using C programming language**

## References: -


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


### Summer Internship-I

| | |
|---|---|
| Course Code | CSSI310 |
| Course Title | Summer Internship-I |
| Number of Credits | 2 (L: 0, T: 0, P: 0) |
| Prerequisites | Nil |
| Course Category | Internship |

Internships may be full-time or part-time; they are full-time in the summer vacation and part- time during the academic session.

| Sl. no. | Schedule | Duration | Activities | Credits | Hours of Work |
|---|---|---|---|---|---|
| 1 | Summer Vacation after | 3-4 Weeks | Inter/ Intra Institutional Activities ** | 2 | 80 Hours |

| | | | | | |
|---|---|---|---|---|---|
| | 2nd Semester | | | | |

(** Students are required to be involved in Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective Institutions; contribution at incubation/ innovation /entrepreneurship cell of the Institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the Institutes and Participation in all the activities of Institute's Innovation Council for e.g.: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.)

**Benefits to Students:**

- An opportunity to get hired by the Industry/ organization.
- Practical experience in an organizational setting.
- Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching.
- Helps them decide if the industry and the profession is the best career option to pursue.
- Opportunity to learn new skills and supplement knowledge.
- Opportunity to practice communication and teamwork skills
- Opportunity to learn strategies like time management, multi-tasking etc. in an industrial setup.
- Opportunity to meet new people and learn networking skills.
- Makes a valuable addition to their resume.
- Enhances their candidacy for higher education.
- Creating network and social circle and developing relationships with industry people.
- Provides opportunity to evaluate the organization before committing to a full-time position.

**Course Outcome:-**

After completion of the course, students will be able to:

C.O.1: Explain the real life organizational and industrial environment situations (K2).

C.O.2: Develop organizational dynamics in terms of organizational behaviour, culture and professional ethics (K1).

C.O.3: Understand the importance of Team work (K2).

C.O.4: Explain invaluable knowledge and networking experience (K2). C.O.5: Develop skill to build a relationship with a prospective employer (K3).

**Course Content:-**

Internships are educational and career development opportunities, providing practical experience in a field or discipline. The Summer Internship-I is a student centric activity that would expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training:

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be used in classroomdiscussions.

- Create conditions conducive to quest for knowledge and its applicability on the job.
- Learn to apply the Technical knowledge in real industrial situations.
- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
- Promote academic, professional and/or personal development.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
- Understand the psychology of the workers and their habits, attitudes and approach to problemsolving.

**Overall compilation of Internship Activities / Credit Framework:**

| **Major Head of Activity** | **Credit** | **Schedule** | **Total Duration** | **Sub Activity Head** | **Proposed Document as Evidence** | **Evaluated by** | **Performance appraisal/ Maximum points/ activity** |
|---|---|---|---|---|---|---|---|
| | | | | Inter/ Intra Institutional Workshop / Training | Certificate | Programme Head | Satisfactory/ Good/ Excellent |
| | | | | Working for consulta | Certificate | Programme Head | Satisfactory/ Good/ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Inter/ Intra Institutional Activities | 2 | Summer Vacation after 2nd Semester | 3-4 Weeks | ncy/ research project | | | Excellent |
| | | | | Festival (Technical / Business / Others) Events | Certificate | Programme Head | Satisfactory/ Good/ Excellent |
| | | | | Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council | Certificate | Cell In-charge | Satisfactory/ Good/ Excellent |
| | | | | Learning at Departmental Lab/Tinkering Lab/ Institutional workshop | Certificate | Cell In-charge | Satisfactory/ Good/ Excellent |

## STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed at the end of each day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and get ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

**INTERNSHIP REPORT**

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course.