



BON SECOURS COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A++' Grade by NAAC
 Affiliated to Bharathidasan University, Tiruchirappalli
 UGC Recognized 2(f) and 12(B) Institution
 Vilar Bypass, Thanjavur – 613006, Tamil Nadu

DEPARTMENT OF INFORMATION TECHNOLOGY

SEMESTER-I

SYLLABUS

Generic/Cluster Core - I	24UCP401	Principles of Programming with C	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Elucidate the basic architecture and functionalities of a Computer	K1-K4
CO2	Understand the programming paradigm of C programming languages	K1-K4
CO3	Implement the concept of arrays, strings and functions	K1-K4
CO4	Apply code reusability with functions and pointers	K1-K4
CO5	Develop C programs using structure, union and file concepts	K1-K4

SYLLABUS

UNIT-I: Principles of Computer & Overview of C: Introduction - Components of a Computer – Concept of Hardware and Software – Art of Programming through Algorithms and Flowcharts - History of C – Importance of C – Sample Programs – Basic Structure of C programs – Executing C Program.

UNIT-II: Constants, Decision Making and Looping: Introduction – Character set – C Tokens - Constants, Variables and Data Types – Declaration of Variables - Declaration of Storage Class – Symbolic Constants – Operators and Expressions – Reading and Writing a Character – Formatted Input – Formatted Output - Decision Making and Branching – Decision Making and Looping.

UNIT-III: Arrays & Functions: Arrays – one dimensional array – Declaration & Initialization and access- 2D arrays and multidimensional arrays- Strings – defining strings, initializing, accessing String handling functions- Functions Introduction – Elements of User – defined Functions – Definition of Functions – Function Declaration – Category of Functions – Nesting of functions - Recursion – Passing Arrays to Functions.

UNIT-IV: Structure & Union Structures: Introduction – Defining a structure – Declaration of structure – Accessing Structures members – Array of Structures – Arrays within Structures - Structures within structures – Structures and functions – Union.

UNIT-V: Pointers & Files: Introduction – Declaring pointer variable – Initialization of Pointer

variables - Chain of Pointers - Pointer Expressions — Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Pointers and Structures - Files: Introduction – Defining and Opening a File – Closing a File – Input / Output operations on files.

TextBooks:

1. E. Balagurusamy, “Programming in ANSI C”, McGraw Hill, 8th Edition, 1st January 2024.

ReferenceBooks:

1. Jyoti Mirani & Vikas B. Agarwal, “Computer Fundamentals”, 2nd Edition, Nirali Prakashan, 2019.
2. Yashavant Kanetkar, “Let Us C”, 18th Edition, BPB Publications, 2021.
3. Szuhay, Jeff, and Szuhay, Jeff, “Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way”, Packt Publishing, 2020.
4. Jena, Sisir Kumar, and Jena, Sisir Kumar, “C Programming: Learn to Code”, 1st Edition, CRC Press, 2021.
5. Reema Thareja, “Programming in C”, 3rd Edition, Oxford University Press, 2023.

E-Resources:

1. <https://www.w3resource.com/c-programming-exercises/>
2. <https://www.javatpoint.com/c-programming-language-tutorial>
3. <https://www.geeksforgeeks.org/best-c-programming-courses-for-beginners/>
4. <https://www.tutorialspoint.com/cprogramming/index.htm>
5. https://onlinecourses.nptel.ac.in/noc22_cs40/preview

Generic/Cluster Core - Laboratory- I	24UCP451	Principles of Programming with C Lab	Credits - 2
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Remember and understand the logic of given concept and construct the programs	K1-K4
CO2	Apply the concept of single and multi-dimensional array to solve problems related to searching, sorting and matrix operations	K1-K4
CO3	Apply the concept of Strings for writing programs related to character array.	K1-K4
CO4	Write programs using concept to user defined and recursive functions.	K1-K4
CO5	Make use of different data-structures like arrays, pointers, structures and files	K1-K4

SYLLABUS

- Write C program
 - To convert temperature from degree Centigrade to Fahrenheit,
 - Find whether given number is even or odd,
 - Find the greatest of three numbers.
- Write a C program to find the sum, average, standard deviation for a given set of numbers.
- Write a C program to print magic square of order n where $n > 3$ and n is odd.
- Write C program to solve quadratic equation using functions.
- Write C program
 - To swap two numbers using call by value
 - To change the elements of an array using call by reference
- Write C program to count the number of vowels in the given sentence.
- Write C program to find the factorial of a given number using a recursive function.
- Write C program to reverse a number using pointer.
- Write C program to check whether the given string is a palindrome using pointers.
- Write C program to print the students mark sheet assuming roll no, name, and marks in 5 subjects in a structure. Create an array of structures and print the mark sheet in the university pattern.
- Write a function using pointers to add two matrices and to return the resultant matrix to the calling function.
- Write a C program which receives two file names as arguments and check whether the file contents are same or not. If same delete the second file.

Tools Required:

- Turbo C

E-Resources:

- Introduction to Programming Lab (iiita.ac.in)
- GitHub - jrTilak/C-Lab-Report: This repository is an invaluable resource for students pursuing a BCT at TU, providing solutions to every lab question. With meticulous attention to detail, each solution includes code, lab reports in both PDF and DOCX formats, and step-by-step guides.
- Programming & Data Structures Lab (iitkgp.ac.in)
- Virtual Labs (vlabs.ac.in)

Generic/Cluster Core - II	24UCP402	Digital Computer Fundamentals	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand various types of number systems and their conversions	K1-K4
CO2	Familiar with the Boolean algebra, logic gates, logical variables and it's the truth table	K1-K4
CO3	Design and implement variety of logical devices using combinational circuits concepts.	K1-K4
CO4	Analyze sequential circuits like Registers and Counters using flip-flops	K1-K4
CO5	Demonstrate and compare the construction of programmable logic devices and different types of ROM	K1-K4

SYLLABUS

UNIT-I: Number Systems: Digital Systems– Binary numbers – Number base conversions-Octal, Hexadecimal -one's complement and two's complement, Binary Arithmetic, Fixed point representation and Floating point representation of– Signed Binary Numbers - Binary Codes

UNIT-II: Boolean Algebra & Logic Gates: Boolean Algebra –Basic definitions – Axiomatic Definition of Boolean Algebra -Basic Theorems and Properties of Boolean Algebra – Boolean Functions- Canonical and standard forms –The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate- Boolean Algebra and Logic Simplification- DeMorgan's Theorems, Boolean Expressions and Truth Tables, The Karnaugh Map, SOP, POS, Don't care conditions.

UNIT-III: Combinational Logic Circuits: Basic combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR Gates. Functions of Combinational Logic - Adders, Subtractors, Decoders, Encoders, Code Converters, Multiplexers, Demultiplexers.

UNIT-IV: Sequential Circuit Design: Flip flops (RS, Clocked RS, D, JK, JK Master Slave, T, Counters, Shift registers and their types, Counters: Synchronous and Asynchronous counters.

UNIT-V: Memory and Programmable Logic: Introduction, Random access memory, memory decoding, error detection and correction, read only memory, Flash Memory - Special Types of Memories, Magnetic and Optical Storage- programmable logic array, sequential programmable devices.

Text Book:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design", 6th Edition, Pearson Education, 2018.

Reference Book:

1. Donald P leach, Albert Paul Malvino, GoutamSaha, Digital Principles and Application, 8thEdition., McGraw Hill education (India) Private Limited, 2015.
2. Prof. Satish Jain Shashi Singh, “Digital Computer Fundamentals”, 1st Edition, BPB Publications, 2017.
3. Ronald Tocci, Neal Widmer , Gregory Moss,” Digital Electronics Principles and applications,12th Edition, Pearson, 2017.
4. Digital Electronics Circuits and Systems, BishnuCharanSarkar and Suvra Sarkar,1st Edition, Sad-Ul-Tan Prakasani, Burdwan, 2018.
5. Roger L. Tokheim, Patrick E., “Digital Electronics: Principles and Applications”, 9th Edition, McGraw-Hill Education, 2022.

E-Resources:

1. <http://nptel.ac.in/courses.php>
2. <http://jntuk-coeerd.in>
3. <http://electrical4u.com/>

SEMESTER II

Discipline Centric Core III	24UIT501	Relational Database Management Systems	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Remember the Database management system concepts	K1 – K4
CO2	Understand Entities and relationships and relationship.	K1 – K4
CO3	Comparison the Relational Model	K1 – K4
CO4	Analyse the Normalization form	K1 – K4
CO5	Analyse and Implement the design DDL, DML, DCL operations	K1 – K4

SYLLABUS

UNIT-I: Database management system: Definition – purpose of database systems – data abstraction – data models – instances and schemes – data independence – database manager– database administrator – database users – overall system structure.

UNIT-II:Entity Relationship Model: Entities and entity sets – Relationships and Relationship Sets – attributes – mapping constraints – keys –E-R diagram – reducing E-R diagrams to tables – generalization –aggregation.

UNIT-III:Relational Model: the relational algebra – the tuple relational calculus – the domain relational calculus.

UNIT-IV:Normalization: First Normal Form – Second Normal Form – Third Normal Form – Boyce – Codd normal form - Fourth Normal Form.

UNIT-V:Oracle SQL:DDL,DML,DCL operations – integrity constraints – string functions – number functions – data arithmetic – selecting distinct values – working with null values – pseudo columns–grouping and ordering data–sub queries–joins–union, intersect & minus – indexes.

Text Books:

1. “Database System concepts “Abraham Silberschatz, Henry F. Korth, and S.Sudarshan.”- McGraw-Hill Education - The 7th edition, released in 019.
2. “Developing ORACLE FORMS Applications “Albert Lulushi–PHI- 2023.
3. “Oracle the complete reference”,George Koch & Kevin loney – 8th edition, Oracle Press Edition 2017

Reference Books:

1. An Introduction to Database System by C.J. Date., 9th edition (2012)
2. “Principles of database system” Jeffrey D. Ullman, Pearson Publication, 2nd Edition, 2014
3. “Introduction to PL/SQL”, George Koch & Kevin Loney, Oracle Corporation Press-2008

E-Resources:

1. <https://www.w3schools.com/sql/>
2. https://onlinecourses.nptel.ac.in/noc22_cs91/preview
3. <https://archive.nptel.ac.in/courses/106/105/106105175/>
4. <https://www.geeksforgeeks.org/rdbms-full-form/>
5. <https://www.techtarget.com/searchdatamanagement/definition/relational-database>

Discipline Centric Core Laboratory II	24UIT551	Relational Database Management Systems Lab	Credits - 2
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Upon successful completion, students will be able to define program-data independence, data models, database schema, and database instances.	K1 – K4
CO2	The primary benefit of the relational database approach is the ability to create meaningful information by joining the tables.	K1 – K4
CO3	Joining tables allows you to understand the relations between the data, or how the tables connect. SQL includes the ability to count, add, group, and also combine queries.	K1 – K4
CO4	Students can implement Order by and Group by clauses.	K1 – K4
CO5	Students can gain knowledge on How to use SQL for Creating, Modifying and Accessing tables in Database.	K1 – K4

SYLLABUS

1. (Exercise on retrieving records from the table) EMPLOYEES (Employee_Id, First_Name, Last_Name, Email, Phone_Number, Hire_Date, Job_Id, Salary, Commission_Pct, Manager_Id, Department_Id)

- (a) Find out the employee id, names, salaries of all the employees
- (b) List out the employees who works under manager 100
- (c) Find the names of the employees who have a salary greater than or equal to 4800
- (d) List out the employees whose last name is 'AUSTIN'
- (e) Find the names of the employees who works in departments 60,70 and 80
- (f) Display the unique Manager_Id.

2. (Exercise on order by and group by clauses) Create Sales table with the following fields(Sales No, Salesname, Branch, Sales amount, DOB)

- (a) Insert five records
- (b) Calculate total salesamount in each branch
- (c) Calculate average salesamount in each branch .
- (d) Display all the salesmen, DOB who are born in the month of December as day in character format i.e. 21-Dec-09
- (e) Display the name and DOB of salesman in alphabetical order of the month.

3. Employee Database An Enterprise wishes to maintain a database to automate its operations. Enterprise is divided into certain departments and each department consists of employees. The following two tables describes the automation schemas

Dept (deptno, dname, loc) Emp (empno, ename, job, mgr, hiredate, sal, comm, deptno)

- a) Update the employee salary by 15%, whose experience is greater than 10 years.
- b) Delete the employees, who completed 30 years of service.

c) Display the manager who is having maximum number of employees working under him?

d) Create a view, which contain employee names and their manager

4. Consider the following tables namely “DEPARTMENTS” and “EMPLOYEES” Their schemas are as follows,

Departments (dept_no , dept_name , dept_location);

Employees (emp_id , emp_name , emp_salary,dept_no);

a) Develop a query to grant all privileges of employees table into departments table

b) Develop a query to grant some privileges of employees table into departments table

c) Develop a query to revoke all privileges of employees table from departments table

d) Develop a query to revoke some privileges of employees table from departments table

e) Write a query to implement the save point.

5. Develop MYSQL queries to implement the following set operations:

a) Union

b) Union All

c) Intersect

d) Intersect All

6. Develop MYSQL queries to implement the following Aggregate Functions:

a) Sum

b) Count

c) Average

d) Minimum

e) Maximum

f) Group by clause & having clause

7. Develop MYSQL queries to implement the following Join operations:

a) Natural Join

b) Inner Join

c) Outer join (Left Outer, Right Outer and Full Outer)

8. Develop MYSQL queries to implement the nested sub - queries:

a) Set membership (IN, NOT IN)

b) Set comparison (SOME, ALL)

c) Empty relation (Exists, Not Exists)

d) Check for existence of duplicate tuples (UNIQUE, NOT UNIQUE)

9. Develop MYSQL queries to implement the following String operations:

a) String operations using %

b) String operations using _

c) String operations using ASC and DESC

10. Develop MYSQL queries to create a view and expand it.

SEMESTER III

Generic/Cluster Core - IV	24UCP403	Python Programming	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand the basic building blocks of programming constructs	K1 – K4
CO2	Apply control structures such as loops, conditionals, and iterators to solve basic computational problems.	K1 – K4
CO3	Develop modular Python programs using functions, handle files and exceptions effectively, and use standard libraries.	K1 – K4
CO4	Implement object-oriented programming concepts such as classes, objects, methods, encapsulation, polymorphism, and operator overloading.	K1 – K4
CO5	Analyze and work with scientific computing libraries like NumPy and pandas to perform efficient data manipulation and numerical operations.	K1 – K4

SYLLABUS

UNIT-I: Introducing Python: Python on Different Operating Systems: Python on Windows- Python on macOS - Python on Linux -Variables and Assignment Statements – Arithmetic – Function print and an Introduction to Strings.

UNIT-II:Decision Making: The if Statement and Comparison Operators- Objects and Dynamic Typing-Control Statements: If Statement-If Else and If Elif Else Statements -While Statement, For Statement -Iterables, Lists and Iterators -Builtin Range Function -Augmented Assignments –Sequences:Lists and Tuples-Dictionaries and Set-controlled Iteration; Formatted Strings – Sentinel controlled Iteration - Builtin Function Range-Break and Continue Statements.

UNIT-III: Functions: Defining Functions-Functions with Multiple Parameters- Python Standard Library -math Module Functions -Using IPython Tab Completion for Discovery - Default Parameter Values -Keyword Arguments -Arbitrary Argument Lists-Methods: Functions That Belong to Objects- Scope rules- Recursion- Files: Text File Processing - Updating Text Files - Handling Exceptions- finally Clause -Explicitly Raising an Exception.

UNIT-IV: Object Orientation:Custom Class Account- Definition-Composition: Object References as Members of Classes-Controlling Access to Attributes-Properties for Data Access- Account Class Definition-Composition: Object References as Members of Classes - Controlling Access to Attributes-Properties for Data Access- Duck Typing and Polymorphism-

Operator Overloading- Namespaces and Scopes.

UNIT-V: NumPy Basics: Arrays and Vectorized Computation: The NumPy ndarray: A Multidimensional Array Object- Pseudorandom Number Generation- Universal Functions: Fast Element-Wise Array Functions- Array-Oriented Programming with Arrays- File Input and Output with Arrays- Linear Algebra- Getting Started with pandas: Introduction to pandas Data Structures- Essential Functionality.

Text Books:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021(Unit-I-IV)
2. Python for Data Analysis Data Wrangling with pandas, NumPy, and Jupyter, Wes McKinney, oreilly ,3rd Edition,2022(Unit-V)

Reference Books:

1. Python Crash Course by Eric Matthes, 3rd Edition, No Starch Press, January 2023
2. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education (India), 2024.
3. Jeeva Jose and P. SojanLal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Book Publishing Co, 2016.
4. Phill Vega., "Python Programming 2020: Guide to Learn Python, Step by Step, with Practical Exercises, Tips and Tricks”, Independently Published, 2020.
5. Reema Thareja,"Python Programming: Using Problem Solving Approach”, Oxford University Press, 2019.
6. Kanetkar Aditya Yashavant, Kanetkar, Let Us Python, 2nd Edition, BPB Publications, 2020.

E-Resources:

1. <https://www.tutorialspoint.com/python/index.htm>
2. <https://www.w3schools.com/python/default.asp>
3. <https://www.learnpython.org/>
4. <https://nptel.ac.in/courses/106106145>
5. <https://www.tpointtech.com/python-tutorial>

Generic/Cluster Core Laboratory – III	24UCP452	Python Programming Lab	Credits - 2
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand and explain Python syntax, data types, operators, and control structures.	K1 – K4
CO2	Apply functions, loops, and conditional statements to develop modular and logical Python programs.	K1 – K4
CO3	Analyze problems and implement appropriate data structures such as lists, dictionaries, and classes.	K1 – K4
CO4	Develop Python applications using object-oriented concepts and file handling techniques.	K1 – K4
CO5	Implement algorithms for sorting, searching, and graph traversal and demonstrate their functionality.	K1 – K4

SYLLABUS

1. Write a Python program to simulate an ATM using conditional statements.
2. Write a Python program for a BMI calculator with health condition output.
3. Write a Python program to count word frequency in a sentence.
4. Write a Python program to compute the factorial of a number using both loops and recursion.
5. Write a Python program for an inventory management system using dictionary.
6. Write a Python program for an employee attendance tracker using dictionary.
7. Write a Python program to add two matrices of the same size and display the result.
8. Write a Python program to find the transpose of a matrix.
9. Write a Python program for a bank transaction system using functions.
10. Write a Python program for a to-do list application using file handling.
11. Create a program to count the number of times a specific word appears in a given text file.
12. Implement a BankAccount class with methods to deposit, withdraw, and display the balance.
13. Create a Vehicle class and derive Car and Bike subclasses from it.
14. Write a Python program Basic Array Operations using NumPy
15. Write a Python program to create and display a DataFrame using Pandas.
16. Write a Python program to implement a Stack and queue data structure using a list. Include push, pop, peek, and is_empty operations.
17. Write a Python program to implement a singly linked list with the following operations:
Insertion at the end
Deletion of a node by value
Display the list
18. Write a Python program to implement the following sorting algorithm using Bubble Sort.
19. Write a Python program to implement Linear Search and Binary Search.

20. Write a Python program to implement graph traversal using Breadth-First Search (BFS) and Depth-First Search (DFS).

Tools:

1. Python Interpreter
2. Integrated Development Environments (IDEs) / Code Editors
3. Command Line / Terminal
4. Package Manager.
5. Additional Python Libraries.
6. IPython / Jupyter Notebook.
7. Text Editors.
8. Version Control System.

E-Resources:

1. <https://docs.python.org/3/>
2. <https://www.w3schools.com/python/>
3. <https://www.geeksforgeeks.org/python-programming-language/>
4. <https://www.programiz.com/python-programming>
5. <https://pandas.pydata.org/docs/>

Generic/Cluster Core Course - V	24UCP404	Data Structures and Algorithms	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Explain the concept of algorithms and analyze their performance using asymptotic notations.	K1 – K4
CO2	Implement and use linear data structures (arrays, stacks, queues, linked lists).	K1 – K4
CO3	Apply tree and graph-based data structures for hierarchical and networked data modelling.	K1 – K4
CO4	Design and implement efficient sorting and searching algorithms using Divide and Conquer.	K1 – K4
CO5	Solve optimization problems using Greedy and Backtracking techniques.	K1 – K4

SYLLABUS

UNIT-I: Introduction of Algorithms, Analysing Algorithms: Theoretical Foundation, Algorithms and its Specification, Random Access Machine Model, Counting Primitive Operations, Notion of best case, average case and worst case, Characterizing Run Time, Use of asymptotic notation, Big-Oh Notation, Little-Oh, Omega and Theta Notations. Arrays: Sparse Matrices–Representation of Arrays. Stacks and Queues. Fundamentals–Evaluation of Expression Infix to Postfix Conversion –Multiple Stacks and Queues.

UNIT-II: Linked List: Singly Linked List – Linked Stacks and Queues – Polynomial Addition-More on Linked Lists – Sparse Matrices – Doubly Linked List and Dynamic – Storage Management –Garbage Collection and Compaction.

UNIT-III: Basic Terminology – Binary Trees – Binary Tree Representations – Binary Trees-Traversal-More on Binary Trees – Threaded Binary Trees – Binary Tree. Representation of Trees – Counting Binary Trees. Graphs: Terminology and Representations-Traversals, Connected Components and Spanning Trees, Shortest Paths and Transitive Closure.

UNIT-IV: Introduction to Algorithms - Divide and Conquer Algorithms – Priority Queues - Heaps – Heap Sort – Merge Sort – Quick Sort – Binary Search – Finding the Maximum and Minimum.

UNIT-V: Greedy Method: The General Method – Knapsack Problem – Minimum Cost-Spanning Trees– Optimal Merge Patterns- Single-Source Shortest Paths. Back Tracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structure", Galgotia Publications, 2014. (UNIT I-III)
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms", University Press, 2014. (UNIT IV&V)

Reference Book:

1. Seymour Lipschutz, "Data Structures", Tata McGraw Hill, Schaum's Outline Series, 2014.

E-Resources:

1. <https://www.geeksforgeeks.org/dsa-tutorial-learn-data-structures-and-algorithms/>
2. https://www.google.com/search?q=HackerRank&rlz=1C1ONGR_enIN961IN962&oq=HackerRank&aqs=chrome..69i57.1016j0j4&sourceid=chrome&ie=UTF-8
3. <https://www.edx.org/masters/micromasters/ucsandiegox-algorithms-and-data-structures>

SEMESTER IV

Discipline Centric Core - VI	24UIT502	Distributed Operating System	Credits - 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Remember the concepts of Distributed Operating Systems (DOS)	K1 – K4
CO2	Understand the architecture and functions of DOS	K1 – K4
CO3	Apply synchronization techniques like logical clocks and time synchronization algorithms	K1 – K4
CO4	Analyze consistency models and fault tolerance protocols	K1 – K4
CO5	Evaluate and design distributed file systems and object-based systems	K1 – K4

SYLLABUS

UNIT-1: Introduction of Distributed Operating System (DOS), Functions of DOS, Basic concepts, goals & challenges of distributed systems, architectures of DOS. Revisit the inter process communication.

UNIT-II: Time and Global States: Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States, Distributed Debugging. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Consensus and Related Problems.

UNIT-III: Synchronization: Introduction of synchronization, Clocks, events, Time in distributed systems 1. Cristian's algorithm 2. The Berkeley Algorithm, 3. Network Time Protocol (NTP) 4. Logical time and logical clocks 5. Lamport logical clock 6. vector clock.

UNIT-IV: Consistency, Replication And Fault Tolerance - Data Centric Consistency Models, Client-Centric Consistency Models, Replica Management, Consistency protocols, Fault Tolerance, Process Resilience, Distributed Commit, Reliable Client Server Communication, Reliable Client Server Communication.

UNIT-V: Distributed Object Based Systems And Distributed File Systems - Distributed object based systems, DOO Architecture, DOO Process, DOO Communication, Synchronization,

Consistency and Replication, Distributed File Systems, Process and Communications, Synchronization in Object Based Systems, Consistency and Replication.

Text Book:

1. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India
2. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez, Prentice Hall International

E-Resources:

1. <https://Distributed-Operating-Systems-Concepts-Design/dp/0201702398>
2. <https://ocw.mit.edu/courses/6-824-distributed-computer-systems-engineering-spring-2022/>
3. <https://Distributed-Systems-Concepts-Design-5th/dp/0132143011>
4. <https://Modern-Operating-Systems-Andrew-Tanenbaum/dp/013359162X>
5. <https://www.reddit.com/r/Operatingsystems/?rdt=60286>

Discipline Centric Core Laboratory IV	24UIT552	Linux lab	Credit: 2
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Recall and list various Linux commands	K1 – K4
CO2	Explain the concepts of file permissions, process management, and networking in Linux.	K1 – K4
CO3	Applying basic Linux commands for file management, system navigation, and process control.	K1 – K4
CO4	Analyze system performance using Linux tools like ps, top, vmstat, and identify areas for optimization.	K1 – K4
CO5	Evaluate different shell scripting approaches to optimize task automation and error handling.	K1 – K4

SYLLABUS

1. Study and Practice on various commands like man, passwd, tty, script, clear, date, cal, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, unmask, ulimit, ps, who, w.
2. Check whether the given number is prime or not.
3. Find the biggest of given two numbers.
4. Write a program to check the given number is odd or even. 4. Write a program to generate Fibonacci Series.
5. Write a program to prepare electric bill for domestic consumers. For first 100 units - Rs.0.75/unit For next 100 units - Rs.1.50/unit Above 200 units - Rs.3.00/unit. Prepare the bill for the following format: Customer No. ----- Customer Name ----- Pre.Reading ----- Cur.Reading ----- Units Consumed ----- Charge ----- Signature
6. Write a program to display the result PASS or FAIL using the information given below: Student Name, Student Reg. No., Mark1, Mark2, Mark3, Mark4. The minimum pass for each subject is 50.
7. Write a program to prepare a Payroll with Basic Pay, DA, Allowances, PF and Gross Pay.
8. Using Case Statement, write a program to check the files ending with vowels.
9. Write a single program to sort the names and numbers in alphabetical, ascending and descending order.
10. Write a menu driven program to print Bio-data for five persons.

Tools Required

1. Linux Operating System

E-Resources:

1. <https://Linux-Bible-Christopher-Negus/dp/111957888X>
2. <https://mlrit.ac.in/wpcontent/uploads/files/CSE/MLR17/LINUX%20PROGRAMMING.pdf>
3. https://mrcet.com/downloads/digital_notes/IT/LINUX%20PROGRAMMING%20%28R15A0527%29.pdf
4. <https://www.nrcmec.org/pdf/Manuals/CSE/student/4-1%20lp16-17.pdf>

SEMESTER-V

Discipline Centric Core VII	24UIT503	Computer Networks	Credit: 4
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Course Outcomes:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Explain the components, topologies, and architectures of computer networks and the OSI/TCP-IP models.	K1 – K4
CO2	Describe data transmission methods, guided and unguided media, and the physical layer mechanisms.	K1 – K4
CO3	Apply error detection/correction, framing, and medium access control techniques for reliable data transfer.	K1 – K4
CO4	Analyze and compare different routing algorithms, congestion control strategies, and internetworking principles.	K1 – K4
CO5	Explain the working of transport and application layer protocols such as TCP, UDP, HTTP, DNS, and SNMP.	K1 – K4

SYLLABUS

UNIT-I: Introduction: Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET& Internet, Physical Layer, Guided Transmission media, twisted pair Cable, Coaxial Cable, Fiber Optics, Wireless transmission.

UNIT-II: Data link layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N.

UNIT-III: Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT-IV: Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT -V: Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

Text Book:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

Reference Books:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

E-Resources:

1. <https://open.umn.edu/opentextbooks/textbooks/353>
2. <https://www.geeksforgeeks.org/computer-networks/difference-between-osi-model-and-tcp-ip-model/>
3. <https://www.studytonight.com/computer-networks/comparison-of-osi-and-tcpip-reference-model>
4. <https://open.umn.edu/opentextbooks/textbooks/352>

Discipline Centric Core VIII	24UIT504	Cloud Computing Technologies	Credit: 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Explain cloud computing concepts and models	K1 – K4
CO2	Analyze virtualization and cloud infrastructure	K1 – K4
CO3	Apply cloud services (IaaS, PaaS, SaaS).	K1 – K4
CO4	Evaluate cloud security and data management	K1 – K4
CO5	Design simple cloud-based applications	K1 – K4

SYLLABUS

UNIT-I: Introduction to Cloud Computing: Evolution of Computing, Grid Computing, Utility Computing, Cluster Computing, Cloud Computing Definition, Characteristics of Cloud Computing, On-demand Self-service, Broad Network Access, Resource Pooling, Rapid Elasticity, Measured Service, Cloud Reference Architecture, Cloud Roles (Provider, Consumer, Broker), Service Models (IaaS, PaaS, SaaS), Deployment Models (Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud), Advantages of Cloud Computing, Limitations of Cloud Computing, Cloud Adoption Challenges, Leading Cloud Providers.

UNIT-II: Cloud Infrastructure and Virtualization: Data Center Design and Architecture, Virtualization Concepts, Hardware Virtualization, OS-level Virtualization, Storage Virtualization, Network Virtualization, Hypervisors, Type 1 Hypervisors, Type 2 Hypervisors, Virtual Machines, Containers, Containerization, Docker Basics, Resource Provisioning, Resource Scheduling, Elasticity, Scalability, Virtual Machine Migration, Load Balancing Techniques.

UNIT-III: Cloud Storage and Networking: Cloud Storage Architecture, Block Storage, File Storage, Object Storage, Distributed File Systems, Hadoop Distributed File System (HDFS), Data Replication, Consistency Models, Cloud Databases, SQL Databases, NoSQL Databases, Big Data in Cloud, Cloud Networking Basics, Virtual Private Cloud (VPC), Subnets, Content Delivery Networks (CDN), Load Balancing, Traffic Management.

UNIT-IV: Cloud Services and Platforms: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Cloud Platform Use Cases, AWS, Microsoft Azure, Google Cloud, Compute Services, Virtual Machines, Containers, Storage Services, Database Services, Serverless Computing, Function-as-a-Service (FaaS), API Gateways, DevOps, Continuous Integration (CI), Continuous Deployment (CD), Infrastructure as Code (IaC).

UNIT-V: Cloud Security and Applications: Cloud Security Fundamentals, Threats and Vulnerabilities, Data Security, Encryption, Identity and Access Management (IAM), Security Compliance, Security Standards, Service Level Agreements (SLA), Cloud Migration

Strategies, Backup, Disaster Recovery, Cloud Adoption Case Studies, Edge Computing, Multi-cloud, Green Cloud Computing.

Text Book:

1. Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition, Thomas Erl & Eric Barceló Monroy, Publisher: Pearson, Publication: August 2023 (current updated edition), ISBN: 9780138052188 / 9780138052256
2. Mastering Cloud Computing: Foundations & Applications, 2nd Edition, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Shivananda Poojara, Satish Narayana Srirama, Publisher: Elsevier, Publication: March 2026 latest edition

Reference Book :

1. Cloud Computing (Revised & Updated Edition), Nayan B. Ruparelia, Publisher: The MIT Press, Publication: August 2023 (revised edition), ISBN: 9780262546478
2. Cloud Computing: Theory & Practice — 3rd Edition, Author: Dan C. Marinescu, Publisher: Morgan Kaufmann / Elsevier, Publication: May 2022 (latest available edition).

E- Reference:

1. <https://cloudsvers.com/tutorials>
2. <https://www.mygreatlearning.com/cloud-computing/free-courses>
3. <https://www.mygreatlearning.com/cloud-computing-tutorial/free-courses>
4. <https://learn.microsoft.com/en-us/training/azure/>
5. <https://www.thomaserl.com/book/cloud-computing-concepts-technology-architecture/overview/index.html>

Discipline Centric Core IX	24UIT505	Java Network Programming	Credit: 4
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COURSE OUTCOMES:

CO. No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Describe network basics and protocols.	K1 – K4
CO2	Write Java programs using sockets and streams.	K1 – K4
CO3	Implement multithreaded network applications.	K1 – K4
CO4	Utilize Java APIs for network services.	K1 – K4
CO5	Analyze client-server communication and develop robust applications.	K1 – K4

SYLLABUS

UNIT-I: Java Fundamentals for Networking: Introduction to Java and JVM, Features of Java, Java Program Structure, Data Types, Variables and Operators, Control Statements (if, switch, loops), Arrays and Strings, Object-Oriented Programming Concepts, Class and Object, Constructor, Inheritance, Polymorphism, Abstraction, Encapsulation, Exception Handling, Packages and Access Modifiers, Basics of Collections Framework, Introduction to Java Networking.

UNIT-II: Java Streams & I/O for Networking: Java I/O for Networking, InputStream, OutputStream, Reader and Writer Classes, Buffered and Filter Streams, File I/O, Object Serialization and Deserialization, Working with Network Data Formats (JSON and XML), Data Buffering, Performance Optimization Techniques.

UNIT-III: Socket Programming in Java: Socket Programming Concepts, TCP Client and Server Sockets, ServerSocket and Socket Classes, Handling Timeouts and Exceptions, UDP Datagram Sockets, DatagramPacket and DatagramSocket Usage, Multicast Sockets, Non-blocking I/O using Java NIO, Selectors and Channels for Efficient Network Communication.

UNIT-IV: Multithreading & Concurrency in Networking: Multithreading and Concurrency in Network Applications, Java Threads, Synchronization, Thread Pools using the Executor Framework, Creating Concurrent Servers, Handling Multiple Client Connections, Managing Deadlocks and Shared Resources, High-Performance Concurrency Techniques.

UNIT-V – Advanced Java Networking: Advanced Networking Concepts, Remote Method Invocation (RMI), Distributed Object Communication, URL/URI Handling, Building HTTP Clients, Secure Sockets (SSL/TLS), Authentication and Encryption, Cloud Socket Programming Concepts, Real-World Case Studies including Chat Applications, File Transfer Systems, and REST Clients

Text Book:

1. Java: A Beginner's Guide, Herbert Schildt, McGrawHill ,Edition: Latest (2023 or 2024)
2. Beginning Java 17 Fundamentals, Kishori Sharan, Publisher:Apress / Springer, Edition: Latest (2021 or newer)

Reference Book:

1. Java: The Complete Reference, Author: Herbert Schildt, Publisher: McGraw Hill ,Edition: 12th / Latest (2023–2024)
2. Core Java Volume I – Fundamentals (11th / Latest Edition), Author: Cay S. Horstmann, Publisher: Pearson, Edition: Latest (2020+; updated to recent Java versions)

E-Reference:

1. <https://docs.oracle.com/javase/tutorial/networking/>
2. <https://docs.oracle.com/en/java/javase/>
3. <https://docs.oracle.com/en/java/javase/18/docs/api/java.base/java/net/package-summary.html>
4. <https://www.geeksforgeeks.org/java-networking/>
5. https://www.tutorialspoint.com/java/java_networking.htm

Discipline Centric Core X	24UIT506	IoT Systems and Device Sensor Networks	Credit: 4
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand general concepts of Internet of Things.	K1-K4
CO2	Analyze various M2M and IoT architectures.	K1-K4
CO3	Understand different IoT models.	K1-K4
CO4	Identify different sensors which can measure different parameters or activity.	K1-K4
CO5	Create IoT solutions using sensors, Arduino and Raspberry Pi.	K1-K4
CO6	Learn genesis and impact of IoT applications in the real world.	K1-K4

SYLLABUS

UNIT-I: Introduction to IoT: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I, Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II.

UNIT-II: 2 IoT Communication Architectures and Protocols: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II, Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications.

UNIT-III: Arduino and Raspberry Pi: Interoperability in IoT, Introduction to Arduino programming: Part I, Part II, and Integration of sensors and actuators with Arduino: Part I, Part II, Introduction to Python programming, Introduction to Raspberry Pi.

UNIT-IV :IoT to Cloud: Introduction to SDN, SDN for IoT, SDN for IoT, Data handling and analytics, Cloud computing, Sensor-Cloud.

UNIT-V :5 IoT to Web of Things: Fog computing, Smart cities and smart Homes connected vehicles, Smart grid, Industrial IoT.

Text Book:

1. S. Misra, A. Mukherjee, and A. Roy – “Introduction to IoT” Cambridge University Press, 2020.
2. S. Misra, C. Roy, and A. Mukherjee, 2020 – Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

Reference Books:

1. Vasudevan, Nagrajan and Sundaram – “Internet of Things”, Wiley India.

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle – “From Machine-To-Machine to The Internet of Things: Introduction to a New Age of Intelligence”, Academic Press.

E-Resources:

1. <https://www.iotforall.com/>
2. https://www.tutorialspoint.com/internet_of_things/
3. <https://www.coursera.org/specializations/internet-of-things>
4. <https://nptel.ac.in/courses/106105166>
5. <https://www.w3schools.com/iot/>

Discipline Centric Core Laboratory V	24UIT553	Java Network Programming Lab	Credit: 2
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand the basics of network communication and protocols.	K1-K4
CO2	Develop client-server applications using Java sockets.	K1-K4
CO3	Implement TCP and UDP-based communication.	K1-K4
CO4	Develop real-time applications such as chat systems and file transfer systems	K1-K4
CO5	Apply networking concepts to solve practical problems	K1-K4
CO6	Learn genesis and impact of IoT applications in the real world.	K1-K4

SYLLABUS

1. Program to display the IP address of a given website.
2. Program to find the host name from an IP address.
3. Program using URL class to display protocol, host, port, and file.
4. Program to read and display contents of a web page.
5. Program to check whether a website is reachable.
6. Program to download a file from the internet.
7. Program to display all headers of a web page.
8. Program using URLConnection to get content type and length.
9. Program to open and read data from a URL stream.
10. Program to count number of words in a web page.
11. Program to display last modified date of a web resource.
12. Program to read data from multiple websites.
13. Program to fetch and display HTML source code.
14. Program to measure response time of a website.
15. Program to display cookies of a website.

Tools Required:

1. Java Development Kit (JDK) – to compile and run Java programs
2. IDE (Eclipse / IntelliJ IDEA / NetBeans) – for writing and testing code
3. Web Browser (Chrome / Firefox) – to verify web outputs
4. Command Prompt / Terminal – to execute Java programs
5. Internet Connection – for accessing web resources and URLs

E-Resources:

1. <https://www.geeksforgeeks.org/java/java-networking-programs/>
2. <https://www.geeksforgeeks.org/java/java-networking/>
3. <https://www.oxzus.net/tutorials/java/java-network-programming>
4. <https://www.oldtoolbag.com/java/java-networking.html>
5. <https://www.javaspring.net/blog/network-programming-with-java/>
6. <https://www.udemy.com/course/java-network-programming/>
7. <https://www.udemy.com/course/java-network-programming-recipes-for-building-web-services/>
8. <https://www.oreilly.com/library/view/java-network-programming/9781449365936/>

Discipline Centric Elective – I	24UIT701	Disruptive Information Technologies	Credit: 4
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand the meaning, examples, and importance of disruptive technology, and how it differs from traditional technology.	K1-K4
CO2	Explain key emerging technologies such as AI, ML, IoT, Cloud Computing, and Blockchain.	K1-K4
CO3	Analyze real-world applications in smart homes, cities, online shopping, digital payments, healthcare, education, and digital marketing.	K1-K4
CO4	Evaluate how businesses and society are affected by disruptive technologies, including advantages, challenges, and future job opportunities.	K1-K4
CO5	Discuss data privacy, cyber safety, responsible use of technology, and digital ethics.	K1-K4

SYLLABUS

UNIT-I: Introduction to Disruptive Technology: Meaning of Disruptive Technology, Examples of Disruptive Technology, Difference between Traditional and Disruptive Technology, Importance of Innovation in Information Technology.

UNIT-II: Emerging Technologies: Artificial Intelligence (AI) and Machine Learning (ML), Internet of Things (IoT), Cloud Computing, Blockchain Technology.

UNIT-III: Applications of Disruptive Technology: Smart Homes and Smart Cities, Online Shopping and Digital Payments, Healthcare Applications, Education Applications, Social Media, Digital Marketing.

UNIT-IV: Impact on Business and Society: How Businesses Change with New Technologies, Advantages of Disruptive Technologies, Challenges of Disruptive Technologies, Future Job Opportunities in Technology.

UNIT-V: Ethics and Security: Data Privacy and Cyber Safety, Responsible Use of Technology, Digital Citizenship, Ethics in Technology.

Textbook:

1. The Innovator's Dilemma by Clayton M. Christensen, Harvard Business Review Press, ISBN: 978-1633691780, Pages: 1–100, 101–200, 201–300, 301–380, 381–450.
2. Artificial Intelligence A Modern Approach by Stuart Russell&Peter Norvig, Pearson, ISBN: 978-0134610993, Pages: 1–120, 121–250, 251–400, 401–550, 551–700.

3. Internet of Things A Hands-On Approach by Arshdeep Bahga&Vijay Madisetti, Universities Press, ISBN: 978-8173719547, Pages: 1–90, 91–180, 181–260, 261–340, 341–420.

Reference Book:

1. Blockchain Basics by Daniel Drescher, Apress, ISBN: 978-1484226032, Pages: 1–100, 101–200, 201–300.
2. Cloud Computing A Practical Approach by Anthony T. Velte, Toby J. Velte&Robert Elsenpeter, McGraw-Hill, ISBN: 978-0071626941, Pages: 1–120, 121–240, 241–360.
3. Cyber Security Essentials by Charles J. Brooks, Christopher Grow, Philip Craig&Donald Short, Wiley, ISBN: 978-1119362395, Pages: 1–100, 101–220, 221–350.

E-Resources:

1. <https://www.mygreatlearning.com/academy/learn-for-free/courses/blockchain-basicsmygreatlearning.com>
2. <https://www.blockchain-council.org/ai/free-ai-courses-online/blockchain-council.org>
3. <https://skillsbuild.org/students/course-catalog/artificial-intelligence>IBM SkillsBuild
4. <https://skillsbuild.org/students/course-catalog/emerging-tech-intro>IBM SkillsBuild
5. <https://www.classcentral.com/report/iot-free-online-courses/>Class Central
6. <https://cognitiveclass.ai/courses>cognitiveclass.ai
7. <https://www.cognitiveclass.ai/courses/blockchain-iot-node-red-food-network>

Discipline Centric Elective Laboratory I	24UIT751	Information Technology Tools Lab	Credit: 2
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Identify and understand various computer hardware components and their functions.	K1-K4
CO2	Assemble and configure a complete computer system and access BIOS/UEFI settings.	K1-K4
CO3	Install and configure operating systems and essential application software.	K1-K4
CO4	Connect and operate peripheral devices such as printers, scanners, and external storage.	K1-K4
CO5	Identify and understand various computer hardware components and their functions.	K1-K4

SYLLABUS

1. Open a desktop to identify motherboard, CPU, RAM, GPU, power supply, hard drives, keyboard, mouse, and monitor.
2. Assemble a desktop PC, connect CPU, RAM, storage, GPU, power supply, and peripherals. Power on and check for successful boot.
3. Access BIOS/UEFI, set date/time, configure boot sequence, enable/disable devices, and save settings.
4. Install Windows or Linux on a physical machine or VM. Configure partitions, user accounts, and essential drivers.
5. Install MS Office and create a document, spreadsheet, and presentation. Install a code editor (e.g., VS Code) and run a sample program.
6. Connect a printer, scanner, or external storage. Install drivers, print a test page, scan a document, and transfer files to/from external storage.
7. Create folders, move/copy files, compress files into ZIP, and perform a system backup. Restore files from backup.
8. Detect and fix common hardware issues such as unrecognized RAM, disconnected hard drive, or malfunctioning keyboard/mouse.

Tools Required:

1. Hardware and Software

E-Resources:

1. <https://www.coursera.org/learn/computer-hardware>
2. <https://nptel.ac.in/courses/106105217>
3. <https://www.geeksforgeeks.org/computer-hardware-components/>
4. <https://support.microsoft.com/en-us/windows/install-windows>
5. <https://www.virtualbox.org/manual/UserManual.html>
6. <https://learn.microsoft.com/en-us/training/office/>
7. <https://www.w3schools.in/computer-fundamentals/computer-hardware-and-software>

Discipline Centric Elective – I	24UIT709	Artificial Intelligence	Credit: 4
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Explain the foundational concepts and history of AI.	K1-K4
CO2	Design and implement basic AI search and optimization algorithms.	K1-K4
CO3	Represent knowledge and apply reasoning for intelligent decision-making	K1-K4
CO4	Understand and apply basic machine learning models.	K1-K4
CO5	Analyze real-world problems and propose AI-based solutions	K1-K4

SYLLABUS

UNIT – I: Artificial Intelligence: AI Problems – Underlying Assumption – AI Technique – Level of the Model – Criteria of Success – Some General References , Problems, Problem Spaces, and Search: Defining the Problem as a State Space Search – Production Systems .

UNIT – II: Heuristic Search Techniques: Generate and Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction – Means-Ends Analysis, Knowledge Representation Issues: Representations and Mappings– Approaches to Knowledge Representation– Issues in Knowledge Representation – The Frame Problem.

UNIT – III: Using Predicate Logic: Representing Simple Facts in Logic– Representing Instance and ISA Relationships – Computable Functions and Predicates – Resolution – Natural Deduction, Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge – Logic Programming – Forward Versus Backward Reasoning – Matching – Control Knowledge.

UNIT – IV: Symbolic Reasoning Under Uncertainty, Introduction to Non-monotonic Reasoning – Logics for Non-monotonic Reasoning – Implementation Issues – Augmenting a Problem-Solver – Implementation Depth First Search – Implementation Breadth First Search .

UNIT – V: Semantic Nets – Frames – Conceptual Dependency – Scripts – CYC – Syntactic-Semantic Spectrum of Representation – Logic and Slot-and-Filler Structures – Other Representational Techniques .

Text Book:

1. Artificial Intelligence, Stuart J. Russell and Peter Norvig, A Modern Approach (4th Edition – 2020 / Global Edition published ~2021–2024)

2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2017
3. M. Tim Jones, - Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers Inc.; First Edition, 2008.

References:

1. Nils J. Nilsson, - The Quest for Artificial Intelligence, Cambridge University Press, 2009.
2. Gerhard Welss, - Multi Agents Systems, Second Edition, 2013 5. David L. Poole and Alan K. Mackworth, - Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010. 6. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007

E- Resources:

1. <https://www.coursera.org/learn/ai-for-everyone>
2. <https://www.coursera.org/learn/machine-learning>
3. <https://www.coursera.org/professional-certificates/ai-engineering>
4. <https://www.udacity.com/course/intro-to-artificial-intelligence-with-python-nanodegree>

Discipline Centric Elective Laboratory – I	24UIT754	Artificial Intelligence Using Python Lab	Credit: 2
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Understand core AI programming concepts using Python.	K1-K4
CO2	Implement classical search algorithms (informed & uninformed).	K1-K4
CO3	Solve game and puzzle problems using Python.	K1-K4
CO4	Develop simple intelligent systems.	K1-K4
CO5	Design and evaluate AI solutions for defined problems.	K1-K4

SYLLABUS

1. Breadth First Search (BFS) implementation in Python.
2. Depth First Search (DFS) implementation in Python.
3. Implement Best-First Search algorithm.
4. Implement Heuristic Search / A* algorithm.
5. Solve 8-Puzzle problem using BFS/A* (or similar).
6. Water Jug problem implementation.
7. Tic-Tac-Toe game with minimax/alpha-beta pruning.
8. Travelling Salesman Problem (basic search approach).
9. Tower of Hanoi recursive solution.
10. Monkey and Banana Problem solution.
11. Constraint satisfaction example (e.g., crossword puzzle).
12. n-Queens problem using Python.
13. Magic square problem (odd/even).
14. Implement Alpha-Beta Pruning (game strategy).
15. Design an Intelligent System case (integration task).

Tools Required

1. Python 3.x
2. IDE / Code Editor Options:
3. Git / GitHub
4. Graphical libraries

E- Resources:

1. <https://www.geeksforgeeks.org/artificial-intelligence/breadth-first-search-bfs-for-artificial-intelligence/>
2. <https://www.geeksforgeeks.org/artificial-intelligence/depth-first-search-dfs-for-artificial-intelligence/>
3. <https://www.geeksforgeeks.org/python-ai/>
4. https://www.tutorialspoint.com/artificial_intelligence_with_python/artificial_intelligence_with_python_quick_guide.htm

Ability Enhancement	24UIT381	Network Based Prompt Design and Optimization	Credit: 2
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COURSE OUTCOMES:

CO No.	Upon completion of this course, the students will be able to	Cognitive Level
CO1	Design effective prompts for specific AI tasks using LLMs.	K1-K4
CO2	Optimize prompt parameters (temperature, top-p, context length) to improve AI outputs.	K1-K4
CO3	Apply zero-shot, few-shot, and multi-step prompting techniques for different applications.	K1-K4
CO4	Analyze and evaluate AI outputs using quantitative metrics and human judgment.	K1-K4
CO5	Integrate prompts to build intelligent systems such as chatbots, summarizers, or automated report generators.	K1-K4

Practical Exercises:

1. Basic Prompt Experimentation
2. Prompt Formatting
3. Parameter Tuning
4. Few-Shot Prompting
5. Zero-Shot Prompting
6. Prompt Chaining / Sequential Prompts
7. Instruction vs Conversational Prompting
8. Conditional Prompting
9. Bias Detection & Mitigation
10. Context Length Management
11. Creative Prompt Design
12. Task Automation Prompting
13. Evaluation Metrics
14. Reusable Prompt Templates
15. Integrated Project

Tools Required

1. Programming Language: Python 3.x
2. Python Libraries:
 - a. openai – For OpenAI GPT models
 - b. transformers – Hugging Face models
 - c. numpy, pandas – Data handling and preprocessing
 - d. nltk, spacy – NLP support
3. IDE / Notebook:
 - a. Jupyter Notebook / VS Code / PyCharm
4. Hardware:
 - a. PC/Laptop with 4GB+ RAM (8GB recommended)
5. Internet Access: Required for API usage

E-Resources:

1. <https://platform.openai.com/docs>
2. <https://huggingface.co/docs/transformers/index>
3. <https://www.geeksforgeeks.org/artificial-intelligence/>
4. https://www.tutorialspoint.com/artificial_intelligence_with_python/index.htm
5. <https://www.coursera.org/specializations/ai-prompt-engineering>
6. <https://realpython.com/tutorials/ai/>
7. <https://machinelearningmastery.com/calculate-bleu-score-for-text-python/>
8. <https://aclweb.org/anthology/P19-1010.pdf>