Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Engineering Mathematics-II   **Subject Code: A000271(014)**

Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:100   Minimum Marks in ESE:35

UNIT – I   LINEAR ALGEBRA   8 Hours
Systems of linear equations and their solutions using Gauss-elimination; vector space, subspace, spanning sets, linearly independence and dependence, basis and dimension, Rank of matrix; inner product, Gram - Schmidt process.
Linear Transformation, Kernel and images of a linear map, Rank-Nullity Theorem (statement and illustration); eigenvalues and eigenvectors, diagonalization of matrices, Jordan canonical form, quadratic forms: positive definiteness

UNIT-II MULTIPLE INTEGRALS   4 Hours
Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a

double integral – Triple integration in Cartesian coordinates – Volume as a triple integral – Change of

variables between Cartesian and polar coordinates.

UNIT – IIIORDINARY DIFFERENTIAL EQUATIONS   08 Hours
Review of first order differential equations, linear differential equations, homogeneous higher order linear differential equations, non- homogeneous higher order linear differential equations with constant coefficients and reducible to differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), systems of differential equations, applications to electrical circuits.

UNIT – IVPARTIAL DIFFERENTIAL EQUATIONS   5 Hours
Introduction to the partial differential equations, classification of second order PDE, method of separation of variable, solution of one dimensional heat equation and wave equation.

UNIT V   LAPLACE TRANSFORMS   7 Hours
Laplace transforms its properties, Unit step function, Dirac delta functions, Convolution theorem, Inverse Laplace transform and its properties, solving differential equations using Laplace transform.

Text Books
1. Introduction to Linear Algebra (2nd edition) by Serge Lang,Springer.
2. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley easternLtd.

Reference Books
1. Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi.
2. Linear Algebra by Hoffmanand Kunze,(2nd edition) Prentice Hall Publication ,New Delhi.
3. Differential Equations with Applications and Historical notes by George Simmons, Tata Mc-Graw Hill publishing company Ltd, NewDelhi.
4. Advanced Engineering Mathematics by C.R.Wylie, McGraw Hill Publications, NewDelhi.
5. Advanced Engineering Mathematics (7thedition) by Peter V.O'Neil, Thomson. Brooks/Cole, Singapore.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Data Structure Using C   **Subject Code: A000272(022)**

Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:100   Minimum Marks in ESE:35

Prerequisites:
1. C Programming
2. Foundations of Computer Science

Course Objectives :
1. To teach how to design a new user defined, efficient, data types array, stack, queue, list, tree, graph,
   etc. abstract data types and reusable code using object based design techniques.
2. To demonstrate good programming practices, coding standards, modular programming, procedural and object-based way of thinking.
3. To emphasize the design aspects of a new data structure for solving any real life problems.
4. To lay strong emphasis on time complexity analysis techniques and algorithm design techniques.

Course Outcomes :
Student will be able to

1. Analyze data objects, data structures and related concepts.
2. Implement problems using different data structures.
3. Design and implement a database schema for a given problem-domain.
4. Understand and implement trees and graphs.
5. Do Programming in PL/SQL including stored procedures, stored functions, cursors and packages.
6. To appreciate the impact of analytics and big data on the information industry and the external ecosystem for analytical and data services.

UNIT – I   FUNDAMENTAL CONCEPTS   04 Hours
Introduction to Data Structures: Data, Data Objects, Data Types ,Abstract Data Type (ADT) and data structures, Concepts of static and dynamic, linear and nonlinear data structures. Introduction to Algorithms: Definition and Characteristics of an algorithm. Algorithm design tools – flowcharts and pseudo code, notations – algorithm header, purpose, conditions and selection, loops, procedures and sub-algorithms.
Program development: Analysis, Design, Coding, Testing and Verification.

UNIT – II LINEAR DATA STRUCTURES USING SEQUENTIAL ORGANIZATION, SEARCHING
AND SORTING   07 Hours

Concept of sequential organization, arrays as ADT, Storage representation of array, Matrix operations using arrays, String operations (Length, Concatenation, Copy, Palindrome, Reverse, Compare, Substring) without using library functions, Searching: linear and binary search algorithms. Sorting: General concepts–Bubble sort, Insertion sort, Selection sort, Heap sort, Merge sort, Quick sort.

UNIT – III LISTS   08 Hours

List as ADT, Concept of linked organization of data against linked list. Singly linked list, doubly linked list, circular linked list. Representation & manipulations of polynomials/sets using linked lists. Dynamic memory management. Representation of sparse matrix. Addition and transpose of sparse matrix.

UNIT – IV STACKS AND QUEUES   08 Hours

Stack and queue as ADT. Operations on stack and queue. Implementations using arrays and dynamic memory allocation. Application of stack for expression evaluation, expression conversion. Recursion and stacks

UNIT – V TREES AND GRAPHS   08 Hours

Basic terminology. Binary trees and its representation. Binary tree traversals (recursive and non-recursive) and various operations. Insertion and deletion of nodes in binary search tree. Representation of graphs using adjacency matrix, adjacency list. Implementation of algorithms for traversals; implementing Kruskal's, Prim's algorithms. Single source shortest paths using Dijkstra's algorithm. Applications of graphs and trees.

UNIT – VI ALGORITHM ANALYSIS AND ALGORITHM DESIGN STRATEGIES   08 Hours

Algorithm Analysis: Time Complexity–Bigoh'O',Omega'Ω', Theta'θ',Best, Average and Worst case analysis: binary search, quick sort, merge sort, insertion sort.
Algorithmic Strategies: Divide and Conquer (quick sort and Tower of Hanoi),Backtracking(n-queens problem), greedy (job scheduling), dynamic programming, branch and bound.

Text Books

1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1.

Reference Books

1. E.Horowitz,S.Sahni,S.Anderson-freed,"FundamentalsofDataStructuresinC",SecondEdition, University Press, ISBN 978-81-7371-605-8
2. c, Prentice Hall of India, Second Edition, ISBN81-203-0596-5
3. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi.
4. Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc- Graw Hill International Editions, 2nd edition 1984,ISBN-0-07-462471-7.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Object Oriented Programming   **Subject Code: A000273(022)**
Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:100   Minimum Marks in ESE:35

UNIT – I INTRODUCTION   06 HOURS
Object oriented programming, Introduction, Application, characteristics, difference between object oriented and procedure programming, Comparison of C and C++, Cout, Cin, Data Type, identifiers

UNIT – II OBJECT AND CLASSES   08 HOURS
Implementation of class and object in C++, access modifiers, object as data type, constructor, destructor, Object as function arguments, default copy constructor, parameterized constructor, returning object from function,Structuresandclasses,Classesobjectsandmemory,staticclassdata,Arraysofobject,Arraysasclass Member Data, the standard C++ String class, Run time and Compile time polymorphism.

UNIT – III   OPERATOR OVERLOADING AND INHERITANCE   08 HOURS
Overloading unary operators, overloading binary operators, data conversion, pitfalls of operators overloading, Concept of inheritance, Derived class and base class, access modifiers, types of inheritance, Derived class constructors, member function, public and private inheritance.

UNIT – IV POINTER AND VIRTUAL FUNCTION   08 HOURS
Addresses and pointers, the address-of operator & pointer and arrays, Pointer and Function pointer, Memory management:NewandDelete,pointerstoobjects,debuggingpointers,VirtualFunction,friendfunction,Static function, friend class, Assignment and copy initialization, this pointer, dynamic type information.

UNIT – V STREAMS AND FILES   08 Hours
Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, printer output, Function templates, Class templates Exceptions, Containers, exception handling.

Text Books
1. E. Balaguruswami," Object Oriented Programming in C++",TMH.
2. Robert Lafore, "Object Oriented Programming in C++",Pearson.

Reference Books
1. M.T. Somashekare, D.S. Guru, "Object-Oriented Programming with C++",PHI.
2. Herbert Shildt, "The Complete Reference C++", Tata McGraw Hill publication.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Digital Logic & Design   **Subject Code: A000274(028)**

Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:100   Minimum Marks in ESE:35

UNIT – I
Boolean Algebra and DeMorgan's Theorem, Logic Simplification SOP &POS forms, Canonical forms, Karnaugh maps, Binary codes, Code Conversion.

UNIT – II
Combinational Logic Design: Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Comparators, Multiplexers, De-multiplexers, Encoder, Decoder, Display, Barrel shifter and ALU. Concept of PLDs like PAL, PLA, CPLDs, FPGA etc. Logic implementation using Programmable Devices (ROM, PLA).

UNIT – III
Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT – IV
Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements.

UNIT – V
VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in Verilog HDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation. Verilog constructs and codes for combinational and sequential circuits.

Text Books/ Reference Books:
1. M. Morris Mano, "Digital Design with Verilog HDL" Pearson Education.
2. Stephan Brown, "Fundamentals of Digital Logic with Verilog Design", Tata Mc Graw Hill.
3. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill.
4. Gothman, "Digital Electronics-An introduction to theory and practice", Pearson Education
5. Douglas-Hall, "Digital Circuits and Systems", Tata McGraw Hill
6. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Suns of tPress

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Python for Data Science   **Subject Code: A000275(022)**

Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:100   Minimum Marks in ESE:35

UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators.
Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

UNIT 2: FILE, EXCEPTION HANDLING AND OOP

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling.
OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT 3: INTRODUCTION TO NUMPY

NumPy Basics: Arrays and Vectorized Computation- The Num Pynd array- Creating ndarrays- Data Types fornd arrays- Arithmetic with Num Py Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes.
Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods- Sorting-Unique and Other Set Logic.

UNIT 4: DATA MANIPULATION WITH PANDAS

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.
Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership.
Reading and Writing Data in Text Format.

UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- StringManipulation: Vectorized String Functions in pandas.
Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Text Books:
1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython",O'Reilly, 2nd Edition,2018.
3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly,2017.

4. Miller, Bradley, and David Ranum. Problem Solving with Algorithms and Data Structures Using Python. 2nd ed. Franklin, Beedle & Associates, 2011. ISBN: 9781590282571.

Reference Books:

1. Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

E Books

1. https://www.programmer-books.com/introducing-data-science-pdf/
2. https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3. http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf

MOOC

1. https://www.edx.org/course/python-basics-for-data-science
2. https://www.edx.org/course/analyzing-data-with-python
3. https://www.coursera.org/learn/python-plotting?specialization=data-science-python

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Entrepreneurship   **Subject Code: A000276(046)**

Total Theory Periods: 40   **Total Tutorial Periods: 10**

No. of Class tests to: 2(Minimum)   **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours   Maximum Marks in ESE:40   Minimum Marks in ESE:14

Assessment Criteria: Individual and Group Assignments.

Week I: Negotiation
Fundamentals of principled negotiations, Three basic people problems, Objective Criteria for negotiations, Common obstacles in negotiation.

Week II & III: Market Structures
Rationale behind studying market structures, Economic definition of market, Determinants of market structure, Economies of scale, Types of market structures.

Week IV: Market Segmentation
Target Market, Benefits of market segmentation, Types of market segmentation, Market Segmentation Strategy Creation.

Week V: Competitive Analysis
Basics of Competitive Analysis, Kinds of competitors, Selection of competitors for analysis, Competitive analysis framework.

Week VI & VII: Questionnaire Design Methods and Concerns
Qualities of a good questionnaire, Preliminary decisions in questionnaire design, Measuring change over time, Open- and closed-ended questions, Question wording, Question order, Pilot Tests and Focus Groups, Pretests.

Week VIII: Seeking Criticism and Constructive Feedback
Writing to venture capitalists, handling professional correspondence, Networking (offline and online), Participation in Business Plan Competitions to raise funding.

Week IX: Social Psychology and Entrepreneurship
Human mind and decision making, Psychological Paradoxes, Human purchase behaviour and business, Customer incentivization.

Week X: Social Entrepreneurship
Social entrepreneur and the power of new ideas, Articulation of a social problem, Understanding beneficiary experience, importance of ethnographic studies, Operation Realities Analysis, Socio-politics, Scope of venture.

Week XI: People Analytics
Data-based human resource improvement in organization, Measuring and managing performance, Engagement, Culture and Attrition, Informal Communication Management, Law and Ethics of People Analytics.

Week XII: Diversity in Workplace
Importance of Diversity in an organization, Diversity and Performance, Measurement of Diversity, Workplace discrimination, Case study.

Text Books:

1. Mindset, Carol Dweck

2. Leaders: Myth and Reality, General Stanley Mc CHRYSTAL

3. Outliers, Malcom Gladwell

4. Good to Great, Jim Collins

5. Steve Jobs, Walter Isaacson

6. The 7 habits of highly effective people, Stephen Covey

7. Thinking Fast and Slow, Daniel Kahneman

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Data Structure Using C Lab   **Subject Code: A000291(022)**

Maximum Marks in ESE:40   **Minimum Marks in ESE:14**

List of Experiments:

1. Write a program to perform various string operations such as copy, length, reversing, palindrome, concatenation and to find occurrence of a sub-string using and without using library functions.
2. Implement the following Searching and Sorting methods:
   Searching: Sequential/Linear Search and Binary Search
   Sorting: Bubble Sort , Insertion Sort, Selection Sort, Merge Sort, Heap Sort and Quick Sort.
3. Implementation of Expression conversion and Evaluation using Stack.
4. Implementation of operations on Priority Queue.
5. Implementation of operations on Binary tree.
6. Implementation of Expression Tree Traversals.
7. Implementation of operations on Binary search tree.
8. Implementation of DFS & BFS Graph Traversals techniques.
9. Implementation of minimum spanning tree using Prime's, Kruskal's and Dijkstra'salgorithm.
10. Implementation of operations on sequential file

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Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Object Oriented Programming Lab   **Subject Code: A000292(022)**

Maximum Marks in ESE:40   **Minimum Marks in ESE:14**

List of Experiments:

1. Write a program to find out the largest number using function.

2. Write a program to find the area of circle, rectangle and triangle using function overloading.

3. Write a program to implement complex numbers using operator overloading.

4. Write a program using class and object to print bio-data of the students.

5. Write a program which defines a class with constructor and destructor which will count number of object created and destroyed.

6. Write a program to show applications of different types of inheritances.

7. Write a program to add two private data members using friend function.

8. Write a program using dynamic memory allocation to perform 2x2 matrix addition and subtraction.

9. Write a program to show the application of virtual function.

10. Write a program that store five student records in a file.

11. Write a program to show the application of class/function template.

12. Write a program to show the application of exception handling.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Python for Data Science Lab   **Subject Code: A000293(022)**

Maximum Marks in ESE:40   **Minimum Marks in ESE:14**

UNIT 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING

1. Implement basic Python programs for reading input from console.

2. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in datatypes: Strings, List, Tuples, Dictionary, Set

3. Solve problems using decision and looping statements.

4. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve anygiven problem

5. Handle numerical operations using math and random number functions

6. Create user-defined functions with different types of function arguments.

UNIT 2: FILE, EXCEPTION HANDLING AND OOP

1. Create packages and import modules from packages.

2. Perform File manipulations- open, close, read, write, append and copy from one file to another.

3. Handle Exceptions using Python Built-in Exceptions

4. Solve problems using Class declaration and Object creation.

5. Implement OOP concepts like Data hiding and Data Abstraction.

6. Solve any real-time problem using inheritance concept.

UNIT 3: INTRODUCTION TO NUMPY

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.

2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.

3. Computation on NumPy arrays using Universal Functions and Mathematical methods.

4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.

5. Load an image file and do crop and flip operation using NumPy Indexing.

UNIT 4: DATA MANIPULATION WITH PANDAS

1. Create Pandas Series and DataFrame from various inputs.

2. Import any CSV file to Pandas DataFrame and perform the following:

(a) Visualize the first and last 10 records

(b) Get the shape, index and column details

(c) Select/Delete the records(rows)/columns based on conditions.

(d) Perform ranking and sorting operations.

(e) Do required statistical operations on the given columns.

(f) Find the count and uniqueness of the given categorical values.

(g) Rename single/multiple columns.

UNIT 5: DATA CLEANING, PREPARATION AND VISUALIZATION

1.Import any CSV file to Pandas DataFrame and perform the following:

(a) Handle missing data by detecting and dropping/ filling missing values.

(b) Transform data using apply() and map() method.

(c) Detect and filter outliers.

(d) Perform Vectorized String operations on Pandas Series.

(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

Chhattisgarh Swami Vivekananda Technical University, Bhilai

Branch: B Tech Honours (Artificial Intelligence and Data Science)   **Semester: II**

Subject: Digital Logic & Design Lab   **Subject Code: A000294(028)**

Maximum Marks in ESE:40   **Minimum Marks in ESE:14**

List of Experiments:

1. To verify

   a) DeMorgan's Theorem for 2variables

   b) The sum-of product and product-of-sum expressions using universal gates

2. To design and implement

   a) Full Adder using basic logic gates.

   b) Full Subtractors using basic logic gates.

3. To design and implement 4-bit Parallel Adder/ Subtractors using IC7483.

4. Design and Implementation of 4-bit Magnitude Comparator using IC7485.

5. To realize

   a) 4:1 Multiplexer using gates

   b) 3-variable function using IC 74151(8:1MUX)

6. Realize 1:8 Demultiplexers and 3:8 Decoder usingIC74138

7. To realize the following flip-flops using NAND Gates.

   a) Clocked SR Flip-Flop

   b) JK Flip-Flop

8. To realize the following shift registers usingIC7474

   (a) SISO (b) SIPO (c)PISO

9. To realize the Ring Counter and Johnson Counter usingIC7476.

10. To realize the Mod-N Counter usingIC7490.

11. Simulate Full- Adder using simulation tool.

12. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool