B. Sc. Data Science & Analytics

Syllabus

AFFILIATED COLLEGES

Program Code:***

2024 – 2025 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 26th among Indian Universities by MHRD-NIRF,
World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

BSc Data Science and Analytics

SCHEME OF EXAMINATIONS

Part	Course Title	Ins. hrs /week (Theory)	Examinations				Credits
			Dur. Hrs.	CIA	End Sem Exam	Total	
	Semester-I						
I	Language-I	4	3	25	75	100	4
II	English-I	4	3	25	25	50	3
III	Core 1: Programming in C	5	3	25	75	100	4
III	Core 2: Data structures	5	3	25	75	100	4
III	Core Lab 1: Programming Lab – C	5	3	25	75	100	4
III	Allied 1: Introduction to Linear algebra	5	3	25	75	100	4
IV	Environmental Studies*	2	3		50	50	2
	Total	**30**		**150**	**450**	**600**	**25**
	Semester-II						
I	Language–II	4	3	25	75	100	4
II	English–II	4	3	25	25	50	3
III	Core3: Programming in C++	5	3	25	75	100	4
III	CoreLab2: Programming Lab-C++	5	3	25	75	100	4
III	CoreLab3: Microsoft Excel Lab	3	3	20	30	50	2
III	Allied2: Probability and Inferential Statistics	5	3	25	75	100	3
IV	Value Education– Human Rights*	2	3	-	50	50	2
	Naan Muthalvan - Skill Course Effective English	2		25	25	50	2
	Total	**30**		**170**	**430**	**600**	**24**
	Semester-III						
I	Language-III	4	3	25	75	100	4
II	English-III	4	3	25	25	50	3
III	Core4:JAVA Programming	4	3	25	75	100	3
III	Core5: Database Management Systems	4	3	25	75	100	3
III	CoreLab4:JAVA Programming Lab	3	3	20	30	50	2
III	Allied3: Optimization Techniques	4	3	20	30	50	2
III	SkillbasedSubject1: Data Visualization	3	3	30	45	75	3
IV	Tamil**/ Advanced Tamil*(OR)Non- major elective-I (Yoga for Human Excellence)*/ Women's Rights*	2	3	-	50	50	2
	Naan Mudhalvan skill course	**2**	**3**	**25**	**25**	**50**	**2**
	Total	**30**		**195**	**430**	**625**	**24**
	Semester-IV						
I	Language-IV	4	3	25	75	100	4
II	English-IV	4	3	25	25	50	3

III	Core6: Python Programming	4	3	25	75	100	3
III	Core7: Data Warehousing and Data Mining	4	3	25	75	100	3
III	CoreLab5: Python Programming Lab	3	3	20	30	50	2
III	Allied4: Data Engineering	4	3	20	30	50	2
III	Skill based Subject2 Lab: Mini project using Python Programming / Advanced Excel	3	3	20	30	50	3
IV	Tamil**/Advanced Tamil* (OR) Non-major elective-II (General Awareness*)	2	3	-	50	50	2
	Naan Muthalvan – Skill Course Office Fundamentals	**2**		**25**	**25**	**50**	**2**
	Total	**30**		**185**	**415**	**600**	**24**
	Semester-V						
III	Core8: R Programming	6	3	25	75	100	4
III	Core9: Big Data Analytics	6	3	25	75	100	4
III	CoreLab6: R Programming Lab	5	3	20	30	50	4
III	Elective –I Business Data Analytics /Social Network Analysis/ Time Series Analysis	6	3	25	75	100	4
III	Skill Based Subject 3: Deep Learning	5	3	30	45	75	3
	Naan Mudhalvan skill course	2	3	25	25	50	2
	Total	**30**		**150**	**325**	**475**	**21**
	Semester-VI						
III	Core10: Linux and Shell Programming	6	3	25	75	100	4
III	Core11: Project WorkLab%%	6	-	40	60	100	4
III	CoreLab7: Linux and Shell Programming Lab	3	3	20	30	50	3
III	Elective–II: Web Application Security/ Software Agents /Recommender system	5	3	25	75	100	4
III	Elective-III: Ethical Hacking/ Open-source Software/ Internet of Things	5	3	25	75	100	4
III	Skill Based Subject4: Machine Learning	3	3	20	30	50	3
V	Extension Activities**	-	-	50	-	50	2
	Naan Muthalvan	2		25	25	50	2
	Total	**30**		**230**	**370**	**600**	**26**
	Grand Total			**1080**	**2420**	**3500**	**144**

***No Continuous Internal Assessment (CIA). Only University Examinations.**

****No University Examinations. Only Continuous Internal Assessment (CIA).**

Semester – I

Course Code		Programming in C	L	T	P	C
Core/elective/Supportive		Core: 1	5	0	0	4
Pre – requisite		● Basic knowledge in computers	Syllabus version		2023-24 Onward	

Course Objectives

To introduce the concepts of Procedure Oriented Programming and the various programming constructs of C programming

Expected Course Outcomes

1	Describe about the about the fundamentals of computers, history and various types of software and hardware devices.	K1
2	Interpret the concepts of Variables, Constant, Operators and various types of Expressions	K2
3	Apply the concept of Decision-making statements and looping constructs for solving basic programs	K3
4	Use the concepts of files and pointers inside a C program	K3
5	Develop programs incorporating all the C language constructs	K4
6	Test the correctness of the programs and identify logical and syntax errors	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	Fundamentals of Computers	12

Fundamentals of Computers: Introduction – History of Computers-Generations of Computers-Classification of Computers-Basic Anatomy of a Computer System-Input Devices-Processor-Output Devices-Memory Management – Types of Software- Overview of Operating System- Programming Languages-Translator Programs-Problem Solving Techniques - Overview of C.

UNIT II	Overview of C	11

Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion in expression – operator precedence &associativity - Mathematical functions - Reading & Writing a character - Formatted input and output.

UNIT III	Decision Making and Branching	12

Decision Making and Branching: Introduction – if, if…. else, nesting of if …else statements- else if ladder – The switch statement, The? Operator – The go to Statement. Decision Making and Looping: Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings

UNIT IV	Functions	12

User-Defined Functions: Introduction – Need and Elements of User-Defined Functions- Definition- Return Values and their types - Function Calls – Declarations – Category of Functions- Nesting of Functions - Recursion – Passing Arrays and Strings to Functions - The Scope, Visibility and Lifetime of Variables- Multi file Programs- Structures and Unions.

UNIT V	POINTERS	13 Hours
Pointers: Introduction-Understanding Pointers-Accessing the address of a variable-Declaration and Initialization of pointer Variable – Accessing a variable through its pointer-Chain of pointers- Pointer Expressions – Pointer Increments and Scale factor- Pointers and Arrays- Pointers and Strings – Array of pointers – Pointers as Function Arguments- Functions returning pointers – Pointers to Functions – Pointers and Structures. File Management in C.		
Total Lecture Hours		**60 Hours**
Text Book(S)		
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008.	
Reference Book(s):		
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2. Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L
CO5	S	M	M	L	L	L	L	L	L	L
CO6	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Programming Lab - C	L	T	P	C
Core/elective/Supportive		Core Lab : 1	0	0	5	4
Pre – requisite		● Basic knowledge in computers	Syllabus version		2023-24 Onward	

Course Objectives

To introduce the concepts of Procedure Oriented Programming and the various programming constructs of C programming.

Expected Course Outcomes

1	Apply the various basic programming constructs like decision making statements. Looping statements, functions, structures, pointers and files	K3
2	Design programs using the concept of files in C and be able to simulate operations	K4
3	Determine the efficient techniques in programming to solve various scientific Problems	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

EXERCISE 1	**Implementation of Control structures**	**6**
Develop various C Programs using Control Structures		
Develop various C programs using Switch case.		
EXERCISE 2	**Implementation of Loopings**	**6**
Develop various C program for the implementation of looping		
Develop various C program for the implementation of looping &Conrtol Structures		
EXERCISE 3	**Implementation of Functions**	**9**
Develop a C program to illustrate recursive function.		
Develop a C program to find the palindrome in a given sentence		
Develop a C program to manipulate strings using string functions.		
Develop a C Program using Functions		
EXERCISE 4	**Implementation of Pointers**	**6**
Develop a C program to swap two integers using pointers.		
Develop a C program using Array of Pointers.		
EXERCISE 5	**Implementation of Structures**	**6**
Develop a C program using the structures.		
Develop a C program using Array of Structures.		
EXERCISE 6	**Implementation of Files**	**6**
Develop a C program to calculate electricity bill using files		
EXERCISE 7	**Implementation of Security**	**6**
Develop a C program to encrypt and decrypt a string		
Develop a G program to encrypt and decrypt Files		
Total Lecture Hours		**45Hours**

Text Book(S)	
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008.
Reference Book(s)	
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2. Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Data Structures	L	T	P	C
Core/elective/Supportive		Core: 2	5	0	0	4
Pre – requisite		● Basic knowledge of Programming Constructs	Syllabus version		2023-24 Onward	

Course Objectives

- To introduce the concept of data structures and the types of data structures
- To demonstrate how various data structures can be implemented and used in various applications

Expected Course Outcomes

1	Define the concept of Data structure and list the various classifications of data structures.	K1
2	Demonstrate how arrays, stacks, queues, linked lists, trees, heaps, Graphs and Hash Tables are represented in the main memory and various operations are performed on those data structures.	K2
3	Illustrate the various file organizations like Sequential, Random and Linked organizations.	K2
4	Discover the real time applications of the various data structures	K3
5	Design algorithms for various sorting and searching techniques	K4

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	INTRODUCTION	12 Hours

Introduction: Introduction of Algorithms, Analyzing Algorithms. 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	12

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	NON-LINEAR DATA STRUCTURES	12 Hours

Trees: 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	EXTERNAL – SORTING	12 Hours

External Sorting: Storage Devices -Sorting with Disks: K-Way Merging - Sorting with Tapes Symbol Tables: Static Tree Tables - Dynamic Tree Tables - Hash Tables: Hashing Functions - Overflow Handling.

UNIT V	INTERNAL – SORTING	12 Hours

Internal Sorting: Insertion Sort - Quick Sort - 2 Way Merge Sort - Heap Sort - Shell Sort - Sorting on Several Keys. Files: Files, Queries and Sequential organizations - Index Techniques -File Organizations.

Total Hours 60 Hours

Text Book(s)		
1	Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.	
Reference Book(s)		
1	Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Galgotia Publication.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L
CO5	S	M	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Introduction to Linear Algebra	L	T	P	C
Core/elective/Supportive		Allied : 1	5	0	0	4
Pre – requisite		None	Syllabus version		2023_24 Onward	

Course Objectives

To introduce the computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, and vector spaces

Expected Course Outcomes

1	Explain the concept/theory in linear algebra, to develop dynamic and graphical views to the related issues of the chosen topics as outlined in "course content," and to formally prove theorems	K2
2	Recognize the basic applications of the chosen topics and their importance in the modern science	K3
3	Develop simple mathematical models, and apply basic linear algebra techniques learned from the chosen topics to solve simple problems	K3
4	Report and communicate effectively with others and present mathematical results in a logical and coherent fashion	K4
5	Appraise the power and beauty of mathematics, and solve problems independently and collaboratively as part of a team	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I **15**

Introduction – Vectors and Matrices – Length and Dot Products – Solving Linear Equations – Linear Equations – The Idea of Elimination – Elimination Using Matrices – Rules for Matrix Operations – Inverse Matrices – Elimination = Factorization: A = LU – Transposes and Permutations

UNIT II **15**

Vector Spaces and Subspaces – Spaces of Vectors – The Null space of A: Solving Ax = 0 – The Rank and the Row Reduced Form – The complete solution to Ax=b – Independence, Basis, and Dimensions – Dimensions of the four Subspaces – Orthogonality – Orthogonality of the Four Subspaces – Projections – Least Squares Approximations – Orthogonal Bases and Gram – Schmidt.

UNIT III **15**

Determinants – The Properties of Determinants – Permutations and Cofactors – Cramer's Rule, Inverse, and Volumes – Eigen values and Eigenvectors – Introduction to Eigen values – Diagonalizing a Matrix – Applications to Differential Equations – Symmetric Matrices – Positive Definite Matrices – Similar Matrices – The Singular Value Decomposition

UNIT IV **15**

Singular value Decomposition – Linear Transformations – The Idea of a Linear Transformation – The Matrix of a Linear Transformation – Change of Basis – Diagonalization and the Pseudo inverse.

UNIT V **15**

Complex Vectors and Complex Matrices – Complex Numbers – Hermitian and Unitary Matrices – The Fast Fourier Transform – Applications – Numerical Linear Algebra.

Total Lecture Hours **75 Hours**

	Text Book(s)	
1	Gilbert Strang(2016). Introduction to Linear Algebra, 5th Edition. Wellesley – Cambridge Press	
	Reference Books	
1	S.Lang (1997). Introduction to Linear Algebra. Second Edition. Springer.	
2	Gilbert Strang (2006). Linear Algebra and Its Apllications. Fourth Edition. Cengage Learning.	
3	David C. Lay, Steven R. Lay, and Judi J. McDonald (2014). Linear Algebra and Its Applications. 5th Edition. Pearson.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Semester -II

Course Code		Programming in C++	L	T	P	C
Core/elective/Supportive		Core : 3	5	0	0	4
Pre – requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming	Syllabus version		2021-22 Onward	

Course Objectives

To introduce he concepts of Object Oriented Programming Paradigm and the programming constructs of C++

Expected Course Outcomes

1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects	K1
2	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions	K2
3	Explain the object oriented concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors	K3
4	Explain the various file stream classes; file types, usage of templates and exception handling mechanisms.	K3
5	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	K5
6	Develop programs incorporating the programming constructs of object oriented programming concepts	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction to C++**	**12**

Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If .. else ,jump, goto, break, continue, Switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

UNIT II	**Classes and Objects**	**14**

Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

UNIT III	**Operator Overloading and Inheritance**	**16**

Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.

UNIT IV	**Pointers and Polymorphism**	**18**

Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators –

UNIT V	**File and Exception Handling**	**15**

Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .

Total Lecture Hours	**75 Hours**

Text Book(s)		
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.	
Reference Books		
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.	
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.	
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO6	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Programming Lab – C++	L	T	P	C
Core/elective/Supportive		Core Lab : 2	0	0	5	2
Pre – requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming	Syllabus version		2023-24 Onward	

Course Objectives

To introduce he concepts of Object Oriented Programming Paradigm and the programming constructs of C++

Expected Course Outcomes

1	Apply the various basic programming constructs like decision making statements. Looping statements, functions, concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors	**K3**
2	Illustrate the concept of Virtual Classes, inline functions and friend functions	**K4**
3	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.	**K5**
4	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1		**5**

Write a C++ Program to create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the STACK. Write a member function PUSH () to insert an element and member function POP () to delete an element check for overflow and underflow conditions.

PROGRAM - 2		**5**

Write a C++ Program to create a class ARITHMETIC which consists of a FLOAT and an INTEGER variable. Write member functions ADD (), SUB (), MUL (), DIV () to perform addition, subtraction, multiplication, division respectively. Write a member function to get and display values.

PROGRAM - 3		**5**

Write a C++ Program to read an integer number and find the sum of all the digits until it reduces to a single digit using constructors, destructors and inline member functions.

PROGRAM - 4		**5**

Write a C++ Program to create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operate on the object FLOAT.

PROGRAM - 5		**5**

Write a C++ Program to create a class STRING. Write a Member Function to initialize, get and display stings. Overload the operators ++ and == to concatenate two Strings and to compare two strings respectively

PROGRAM -6		**5**
Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_Number, E_Name, Department, Basic, Salary, Grade. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending onthe grade.		
PROGRAM -7		**5**
Write a C++ Program to create a class SHAPE which consists of two VIRTUAL FUNCTIONS Calculate_Area() and Calculate_Perimeter() to calculate area and perimeter of various figures. Derive three classes SQUARE, RECTANGLE, TRIANGE from class Shape and Calculate Area andPerimeter of each class separately and display the result.		
PROGRAM -8		**5**
Write a C++ Program to create two classes each class consists of two private variables, a integer and a float variable. Write member functions to get and display them. Write a FRIEND Function common toboth classes, which takes the object of above two classes as arguments and the integer and float values of both objects separately and display the result.		
PROGRAM -9		**5**
Write a C++ Program using Function Overloading to read two Matrices of different Data Types such as integers and floating point numbers. Find out the sum of the above two matrices separately and display the sum of these arrays individually.		
PROGRAM -10		**5**
Write a C++ Program to check whether the given string is a palindrome or not using Pointers.		
PROGRAM -11		**5**
Write a C++ Program to create a File and to display the contents of that file with line numbers.		
PROGRAM - 12		**5**
Write a C++ Program to merge two files into a single file.		
Total Lecture Hours		**60 Hours**

Text Book(s)	
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.
	Reference Books
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course code		CoreLab3: Microsoft Excel Lab	L	T	P	C
Core			-	-	2	2
Pre- requisite		Basic knowledge on Computer Applications	Syllabus Version			

Course Objectives:

The main objectives of this course are to:

- enrich students with computer knowledge to draw various diagrams and solving problems in microbiology using MS-Excel.
- provide basic knowledge about Artificial Intelligence in Biological Sciences.
- make students familiar with the Big-Data Analysis.

Programs:

The listed topics to be covered under practical in MS-Excel provided the students have prior exposure in the package.

1. Graphical Representation	a. Histogram b. Ogives c. Scatter diagram
2. Diagrams	a. Line diagram b. Bar diagram c. Pie diagram
3. Measures of Location	a. Mean (Arithmetic, Geometric and Harmonic) b. Median c. Mode
4. Measures of Dispersion	a. Range (max –min) b. Standard Deviation c. Variance d. Coefficient of variation e. Skewness
5. Correlation	a. Karl Pearson's coefficient b. Spearman's Rank c. Coefficient of determination
6. Curve Fitting	a. Linear Regression
7. Parametric tests	a. Normal(z) b. t (Equal Variance) c. F d. Chi square
8. (i) Implement the following file management tasks in Hadoop	a. Adding files and directories b. Retrieving files c. Deleting files
ii) Benchmark and stress test an Apache Hadoop cluster	

Course code		Probability and Inferential Statistics	L	T	P	C
Core/Elective/Supportive		Allied 2	3	1	-	4
Pre-requisite		Basic level on mathematical computation	Syllabus Version	2023-2024		

Course Objectives:

The main objectives of this course are to:

1. Understand the relationship between two variables.
2. Know the concept of association of attributes and methods.
3. Be familiar with the theoretical probability and its concepts.

Expected Course Outcomes:

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

1	Measure and interpret the degree of relationship between variables.	K1, K2, K3
2	Estimate the average relationship using regression.	K3, K4, K5
3	Interpret the association of attributes applying different methods.	K3, K4, K5
4	Understand the concepts of probability and relate to real life situations	K1, K2
5	Apply the theorems in practical problems with conditional probability	K3, K4

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Basics of Probability	9 hours

Probability: Sample Space-Concepts of events- Algebraic operations on events-Definitions of probability.

Unit:2	Properties of Probability	9 hours

Generalized addition and compound Theorems of probability-independent events – Conditional probability, Inverse probability – Baye's Theorem.

Unit:3	Random Variable and Probability Distribution functions	9 hours

Random variables –discrete and continuous random variables –distribution function-properties-probability mass function and probability density function –various statistical measures of continuous probability distribution

Unit:4	Generating Functions	9 hours

Moment generating function, cumulant generating function, characteristic function and their properties.

Unit:5	Theorems on probability of random variable	9 hours

Tchebychev's inequality, convergence in probability, weak law of large numbers and central limit theorem.

Unit:6	Contemporary Issues	2 hours
Expert lectures, Online seminars– Webinars		
	Total Lecture hours	47 hours

Text Book(s)	
1	Fundamentals of Mathematical statistics by Guptha, S.C &Kapoor, V.K (Sulthan chand &sons)
2	Introduction to Mathematical statistics by Hogg.R.V and and Craig ,A.G. (Amerin
Reference Books	
1	Introduction to probability and probability distributions by John Benjamin ofosu and Christian Akrong Hesse
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://mathcs.clarku.edu/~djoyce/ma217/moment.pdf
2	https://www.itl.nist.gov/div898/handbook/eda/section3/eda36.htm
3	https://www.toppr.com/guides/fundamentals-of-business-mathematics-and-statistics/theoretical-distribution/theoretical-distribution/

Semester - III

Course Code		Java Programming	L	T	P	C
Core/Elective/Supportive		Core : 4	4	0	0	4
Pre - requisite		● Knowledge in Basics of Object Oriented Programming	Syllabus version		2022-23 Onwards	

Course Objectives

1. To introduce the concepts of Object-Oriented Programming Paradigm and the programming constructs of JAVA

Course Outcomes

1	Recite the history of JAVA and its evolution	**K1**
2	Explain the various programming language constructs, object-oriented concepts like overloading, inheritance, polymorphism, Interfaces, threads, exception handling and packages	**K2**
3	Illustrate the concepts of Applets, files and the concept of stream classes.	**K3**
4	Outline the benefits and applications of objects oriented programming concepts and defend how JAVA differs from other programming languages	**K3**
5	Judge the pros and cons of other object oriented language with the concepts of JAVA	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Introduction**	**18**

Java Features – comparison of Java with C and C++ - Java and Internet – Java Environment – Java Program structure – Java Tokens – Implementing a Java Program – Java Virtual Machine – Constants – Variables – Data Types – Scope of Variables – Type casting – Operators and expressions – Decision Making, Branching and Looping

Unit II	**Classes and Arrays**	**18**

Defining a class – Constructors – Methods – overloading – static Members – Nesting of Methods – Overriding methods – Final Classes – Abstract Class – Visibility control – Arrays – creating an array – Two Dimensional arrays – Strings – String Arrays – String Methods – String Buffer Class – Vectors – Wrapper Classes.

Unit III	**Inheritance, Interfaces and Packages**	**17**

Defining a subclass – Subclass constructor – Multilevel inheritance – Hierarchical Inheritance – Defining Interfaces – Extending Interfaces – Implementing Interfaces – Java APF Packages – creating a package – Accessing and Using a package – Adding a class to a package – Hiding Classes

Unit IV	**Multithreading Exception Handling**	**19**

Extending the Thread class – Thread Life cycle – Thread Exception – Thread priority – Synchronization – Runnable Interface – Exceptions – Throwing own Exceptions – Concepts of streams – stream classes – Byte Stream Classes – Character stream Classes – Using Streams – Using file Class –Other Stream Classes.

Unit V	**Applet Programming**	**18**

Difference between Application and Applets – Applet Life cycle – creating an Executable Applet – Designing a Web Page – Adding Applet to HTML File – Passing Parameters to Applets

Total Lecture Hours	**90 Hours**

Text Book(s)	
1	E. Balagurusamy, “Programming with Java – A primer”, Second Edition, Tata McGraw Hill Publishing Company, Delhi, 2002.
Reference Book(s)	
1	Herbert Schildt, “The complete Reference – Java 2”, Fifth Edition, Tata McGraw Hill Publishing Company, Delhi, 2002.
2	The Complete Reference Java 2 - Patrick Naughton & Hebert Schildt, 3rd Edition, TMH
3	Programming with Java – John R. Hubbard, 2nd Edition, TMH.
Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview 2. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	M	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Database Management Systems	L	T	P	C
Core/Elective/Supportive		Core : 5	3	0	0	4
Pre - requisite		None	Syllabus version		2022-23 Onwards	

Course Objectives

1. To introduce database development life cycle and conceptual modelling
2. To learn SQL for data definition, manipulation and querying a database
3. To learn relational database design using conceptual mapping and normalization
4. To learn transaction concepts and serializability of schedules
5. To learn data model and querying in object-relational and No-SQL databases

Expected Course Outcomes

1	Understand the database development life cycle and apply conceptual modeling	**K2**
2	Apply SQL and programming in SQL to create, manipulate and query the database	**K2**
3	Apply the conceptual-to-relational mapping and normalization to design relational database	**K3**
4	Determine the serializability of any non-serial schedule using concurrency techniques	**K3**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit I	**Conceptual Data Modeling**	**18**

Database environment –Database system development lifecycle –Requirements collection – Database design --Entity-Relationship model –Enhanced-ER model –UML class diagrams.

Unit II	**Relational Model and SQL**	**15**

Relational model concepts --Integrity constraints --SQL Data manipulation –SQL Data definition –Views --SQL programming.

Unit III	**Relational Database Design and Normalization**	**18**

ER and EER-to-Relational mapping –Update anomalies –Functional dependencies-Inference rules –Minimal cover –Properties of relational decomposition –Normalization upto BCNF.

Unit IV	**Transaction Management**	**18**

Transaction concepts –properties –Schedules –Serializability –Concurrency Control –Two-phase locking techniques.

Unit V	**Object Relational and No-SQL Databases**	**18**

Mapping EER to ODB schema –Object identifier –reference types –row types –UDTs –Subtypes and super types –user-defined routines –Collection types –Object Query Language.

Unit VI	**Contemporary Issues**	**3**

Expert lectures, online seminars – webinars

Total Lecture Hours	**90Hours**

Text Book(s)

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems –A Practical Approach to Design, Implementation and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
2.Ramez Elmasri, Shamkant B. Navathe, Fundamental of Database Systems, 7th Edition, Pearson, 2017.

Reference Book(s)

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, “DATABASE MODELING AND DESIGN -Logical Design”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, “Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
5. S Sumathi, S Esakkirajan, “ Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007.
6. Raghu Ramakrishnan, “Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1	https://www.tutorialspoint.com/oracle_sql/index.html

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	M	M	M	L
CO2	S	S	S	M	S	M	M	M	M	L
CO3	S	S	S	S	S	S	S	S	M	M
CO4	S	S	S	S	S	M	S	S	M	L

*S-Strong; M-Medium; L-Low

Course Code		Java Programming Lab	L	T	P	C
Core/Elective/Supportive		Core Lab : 4	0	0	2	2
Pre - requisite		• Basic knowledge of Programming • Knowledge on Object Oriented Programming Concepts	Syllabus version		2022-23 Onwards	

Course Objectives

To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA

Course Outcomes

1	Apply the various basic programming constructs of JAVA like decision making statements. Looping statements, overloading, inheritance, polymorphism, constructors and destructors	**K3**
2	Illustrate the concepts of threading and multi-threading	**K4**
3	Design programs using various file stream classes; file types, and frames	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1	**3**
Write a Java Applications to extract a portion of a character string and print the extracted string.	
PROGRAM - 2	**3**
Write a Java Program to implement the concept of multiple inheritance using Interfaces.	
PROGRAM - 3	**3**
Write a Java Program to create an Exception called payout-of-bounds and throw the exception	
PROGRAM - 4	**3**
Write a Java Program to implement the concept of multithreading with the use of any three multiplication tables and assign three different priorities to them.	
PROGRAM - 5	**3**
Write a Java Program to draw several shapes in the created windows	
PROGRAM -6	**3**
Write a Java Program to demonstrate the Multiple Selection List-box.	
PROGRAM -7	**3**
Write a Java Program to create a frame with three text fields for name, age and qualification and a text field for multiple line for address	
PROGRAM -8	**3**
Write a Java Program to create Menu Bars and pull down menus.	
PROGRAM -9	**3**
Write a Java Program to create frames which respond to the mouse clicks.	
PROGRAM -10	**3**
Write a Java Program to draw circle, square, ellipse and rectangle at the mouse click positions.	
Total Hours	**30 Hours**

Text Book(s)	
1	Programming with Java – A Primer - E. Balagurusamy, 3rd Edition, TMH.
Reference Book(s)	
2	The Complete Reference Java 2 - Patrick Naughton& Hebert Schildt, 3rd Edition, TMH
Course Designed by : Dr. K.S.MOHANASATHIYA, Assistant Professor, School of Computer Science, VET Institute of Arts and Science (Co-Education) College, Erode	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	L	L	L	L	L	L
CO2	S	S	S	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L
CO4	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Optimization Techniques	L	T	P	C
Core/Elective/Supportive		Allied: 3	5	0	0	4
Pre - requisite		Basic Knowledge in Optimization	Syllabus version		2022-23 Onwards	

Course Objectives

The objective of this course is to enable the student to

1. Formulate and solve linear programming problems (LPP)
2. Evaluate Integer Programming Problems, Transportation and Assignment Problems.
3. Obtain solution to network problems using CPM and PERT techniques.
4. Able to optimize the function subject to the constraints.
5. Identify and solve problems under game theory.

Course Outcomes

1	Demonstrate and Formulate and solve linear programming problems (LPP)	**K1**
2	Evaluate Integer Transportation and Assignment Problems	**K2**
3	Obtain solution to network problems using CPM and PERT techniques	**K3**
4	Apply the strategies of game theory and to make better decisions while solving problems	**K4**
5	Identify and solve problems under replacement models	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Introduction To Operation Research**	**15**

Introduction of Operations Research - Linear programming- Mathematical Formulation- Graphical Method to solve LPP-Simplex Method.

Unit II	**Transportation and Assignment Problems**	**15**

Transportation problems: Introduction- Finding Initial Basic Feasible solutions- moving Towards optimality (non- degenerate only) – Maximization in transportation problem- Unbalanced transportation problem.

Assignment problem: Introduction –Hungarian Assignment method – Maximization in Assignment problem – Unbalanced Assignment problem- Travelling Salesman Problem.

Unit III	**Project Scheduling Hours**	**15**

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM. (Simple Problems Only).

Unit IV	**Game Theory**	**15**

Game theory: Concept of Pure and Mixed strategies – solving 2 x 2 matrices with and without saddle point. Graphical solution - mx2 and 2xn games- Solving games by Dominance Property.

UNIT V	Replacement Theory	15
Theory of Replacement – Introduction - Replacement models –Replacement of items that deteriorates gradually (value of money does not change with time)		
	Total Lecture Hours	**75 Hours**

Text Book(s)

1. P. K. Gupta, Man Mohan, Kanti Swarup: "Operations Research", Sultan Chand, 2008.

Reference Book(s)

1. Sundaresan V, Ganapathy K.S, Ganesan K, Resource Management Technique- Lakshmi Publications, 2003.
2. J. K. Sharma: Operations Research Theory & Applications, Macmillan India Limited, Fifth edition.2013.

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Data Visualization	L	T	P	C
Core/Elective/Supportive		Skill Based Subject 1	6	0	0	4
Pre - requisite		None	Syllabus version		2022-23 Onwards	

Course Objectives

- To introduce the concept of Data Visualization
- To explain the various techniques in Data Visualization

Expected Course Outcomes

1	Understand the basics of data visualization	K2
2	Understand the importance of data visualization and the design and use of many visual components	K2
3	Explain the process of data visualization	K2
4	Explain the basics of interactive data visualization techniques visualization-based issues.	K2
5	Understand the concept of various types of visualization	K2

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	Introduction	15

Introduction- context of data visualization- definition methodology, visualization design objectives. Key factors-purpose, visualization function and tone, visualization design options- data representation, data presenation,seven stages of data visualization,widgets,data visualization tools.

Unit II	Visualizing data methods	15

Visualizing data methods- mapping, time series- connections and correlations-scatter plot maps- trees, hierachies and recursion- networks naadgraphs, info graphics

Unit III	Visualizing data process	15

Visualizing data process- acquiring data, where to find data, tools of acquiring data from the internet, locating file for use with processing, loading text data, dealing with files and folders, lisiting files in a folder, asynchronous image downloads, advanced web techniques, using a database, dealing with large number of files.

Unit IV	Interactive data visualization	12

Interactive data visualization-drawing with data,scales-axes-updates,transaction and mode-interactivity- layouts-geomapping- exporting frame work-T3 lstabio

Unit V	Security data visualization	15

Security data visualization-port scan visualization-vulnerability assessment and exploitation- firewall log visualization- instruction detection log visualization- attacking and defending visualization systems- creating security visualization system

Unit VI	Contemporary Issues	3
	Total Lecture Hours	75 Hours

Text Book(s)	
1	Scott Murray,"interactive data visualization for the web ",O"Reilly media,inc,2013.

Reference Book(s)	
1	Ben fry,"visualizing data",O"Reilly media,inc,2007
2	Greg conti,"security data visualization:","graphical techniques for network analysis",No starch press inc,2007
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Semester -IV

Course Code		Introduction to Python Programming	L	T	P	C
Core/Elective/Supportive		Core : 6	5	0	-	4
Pre - requisite		• Basic knowledge of Python Programming. • Knowledge in Object Oriented Programming Concepts.	Syllabus version		2022-23 Onwards	

Course Objectives

1. To know the basics of algorithmic problem solving with read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.
4. To use Python data structures - lists, tuples, dictionaries and fix input/output with files in Python.

Expected Course Outcomes

1	Develop algorithmic solutions to simple computational problems	**K1**
2	Read, write, execute by hand simple Python programs. Structure simple Python programs for solving problems.	**K2**
3	Decompose a Python program into functions.	**K3**
4	Represent compound data using Python lists, tuples, dictionaries. Read and write data from/to files in Python Programs	**K3**
5	Judge the pros and cons of Python	**K4**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Unit I	**Algorithmic Problem Solving**	**16**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

Unit II	**Data, Expressions, Statements**	**15**

Python interpreter and interactive mode, values and types: int, float, boolean, string and list; variables, expressions, statements, tuple assignment, precedence of operators, comments, modules and functions, function definition and use, flow of execution, parameters and arguments.

Unit III	**Control Flow, Functions**	**14**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration: state, while, for, break, continue, pass. Fruitful functions: return values, parameters, local and global scope, function composition, recursion. Strings: string slices, immutability, string functions and methods, string module, Lists as arrays.

Unit IV	**Lists, Tuples, Dictionaries**	**13**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. Tuples: tuple assignment, tuple as return value, Dictionaries: operations and methods, advanced list processing - list comprehension.

Unit V	**Files, Modules, Packages**	**17**

Files and exception: text files, reading and writing files, format operator, command line arguments, errors and exceptions, handling exceptions, modules, packages.

Total Lecture Hours	**75**

Text Book(s)

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Book(s)

1. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1	http://greenteapress.com/wp/think-python/	

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Data Warehousing and Data Mining	L	T	P	C
Core/elective/Supportive		Core :7	4	0	0	3
Pre - requisite		None	Syllabus version		2023-24 Onward	

Course Objectives

- Introduce the concepts of data ware house and data mining and explain the methodologies used for analysis of data

Expected Course Outcomes

1	Understand the functionality of the various data mining and data warehousing Component	K2
2	Describe different methodologies used in data mining and data ware housing.	K2
3	Explain the analyzing techniques and Online Analytical Processing	K2
4	Explain about the association rule mining and classification	K2
5	Compare different approaches of data ware housing and data mining with various Technologies	K4

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	Data Warehousing	18

Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

UNIT II	Business Analysis	18

Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

UNIT III	Data Mining	17

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing

UNIT IV	Association Rule Mining and Classification	19

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT V	Clustering And Trends In Data Mining	18

Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Total Lecture Hours	90

Text Book(s)	
1	Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, TataMcGraw – Hill Edition, Thirteenth Reprint 2008.
2	Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
Reference Book(s)	
1	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2	K.P. Soman, ShyamDiwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3	G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
4	Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
Course Designed by :	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Python Programming - Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 5	0	0	3	2
Pre - requisite		• Knowledge in basic Programming	Syllabus version		2023-24 Onward	

Course Objectives

- To introduce the concepts of python programming constructs of C++

Expected Course Outcomes

1	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	K3
2	Analyze the concepts of Lists, tuples and error handling mechanisms	K4
3	Evaluate a program incorporating all the python language constructs	K5

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

PROGRAM - 1	Write a python program that displays the following information: Your name, Full address Mobile number, College name, Course subjects.	5
PROGRAM - 2	Write a python program to find the largest three integers using if-else and conditional operator.	5
PROGRAM - 3	Write a python program that asks the user to enter a series of positive numbers (The user should enter a negative number to signal the end of the series) and the program should display the numbers in order and their sum.	5
PROGRAM - 4	Write a python program to find the product of two matrices [A]mxp and [B]pxr	5
PROGRAM - 5	Write recursive functions for GCD of two integers.	5
PROGRAM - 6	Write recursive functions for the factorial of positive integer.	10
PROGRAM - 7	Write recursive functions for Fibonacci Sequence up to given number n.	10
PROGRAM - 8	Write recursive functions to display prime number from 2 to n.	10
PROGRAM - 9	Write a python program that writes a series of random numbers to a file from 1 to n and display.	10
PROGRAM -10	Write a program to calculate student grade	10
PROGRAM -11	Write a python program to make a simple calculator.	10
PROGRAM -12	Write a python program for Linear Search and Binary Search.	10
Total Lecture Hours		**90 Hours**

Text Book(s)	
1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	Martin C. Brown, ―PYTHON: The Complete Referencell, McGraw-Hill, 2001
Reference Book(s)	
1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
2	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
Course Designed by :	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	M	L	L	L	L	L	L	L
CO2	S	S	M	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code	Data Engineering	L	T	P	C
Core / Elective/ Supportive	Allied 4	4	-		3
Pre-requisite		Syllabus Version		2022-23	

Course Objectives:

The main objectives of this course are to:

1. **Identify basic concepts, terminology, theories, models and methods in the field of Data Engineering**
2. **Apply data transformations such as aggregation and filtering for visualization**
3. **Identify opportunities for application of data visualization in various domains.**

Expected Course Outcomes:

On the successful completion of the course, student will be able:

1	Acquire knowledge on various phases of data engineering	K1, K2
2	Identify necessity of data pre-processing and apply the appropriate procedure	K2, K3
3	Demonstrate data warehouse schema and process of data retrieval for real time applications.	K2, K3,K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**–Create

UNIT:1	**DATA ENGINEERING INTRODUCTION**	**8 Hours**

KDD Process – Kinds of data can be mined – Kind of patterns can be mined – Technologies used – Kinds of Applications targeted – Issues in data mining - Data Objects and Attribute Types - Data preprocessing overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization

UNIT:2	**DATA WAREHOUSING**	**10 Hours**

Data warehouse – Basic Concepts –Modeling - Data cube and OLAP – Data warehouse Design and Usage – Implementation - Data Generalization by Attribute Oriented Induction.

UNIT:3	**DATA MODELING**	**10 Hours**

Introduction to data modeling-Relational data models-NoSQL data models-Data Pipelines- Data Quality-Production data Pipelines

UNIT:4	**DATA PROCESSING**	**10 Hours**

ETL basics –Extraction of Data-Extraction Methods-Transportation of data- Transportation mechanisms-ETL Tools-Loading and Transformation. Data Capture-Data warehouse performance-basic query-advanced query-Schema modeling techniques-Analysis and Reporting-OLAP

UNIT:5	**DATA VISUALIZATION**	**10 Hours**

Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

	Total Lecture hours	**48 hours**

Text Book(s)		
1	Paul Crickard “Data Engineering with Python” work with massive datasets to design datamodels and automate data pipelines Using python,2020	
2	Jiawei Han, MichelineKamber, Jain Pei “Data Mining: Concepts and Techniques”, Third edition, Elsevier, Morgan Kaufmann Publishers, 2012.	
Reference Books		
1	Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	L	M	M
CO2	S	S	S	S	L	M	L	M	L	M
CO3	S	S	M	M	L	M	S	M	M	M

*S-Strong; M-Medium; L-Low

Semester - V

Course Code		R Programming	L	T	P	C
Core/elective/Supportive		Core :8	6	0	0	4
Pre – requisite		None	Syllabus version		2023-24 Onward	

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	K2
2	Understand the use of R for Big Data analytics	K2
3	Apply R programming for Text processing	K3
4	Appreciate and apply the R programming from a statistical perspective	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	**Introduction to R**	**18**

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names.

UNIT II	**Matrices and operations**	**18**

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III	**Data Frames**	**18**

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

UNIT IV	**Classes and Objects**	**18**

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

UNIT V	**Modelling in R**	**18**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Book(s)		
1	Mark Gardner, “Beginning R – The Statistical Programming Language”, Wiley, 2013.	
2	Robert Knell, “Introductory R: A Beginner‟s Guide to Data Visualisation, Statistical Analysis and programming in R”, Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O‟Reilly Media.	
3	Garret Grolemund (2014). Hands-on Programming with R. O‟Reilly Media, Inc.	
4	Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		R Programming Lab	L	T	P	C
Core/elective/Supportive		Core Lab :6	0	0	6	4
Pre – requisite		None	Syllabus version		2023-24 Onward	

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Understand the basics in R programming in terms of constructs, control statements, string functions	K2
2	Understand the use of R for Big Data analytics	K2
3	Apply R programming for Text processing	K3
4	Appreciate and apply the R programming from a statistical perspective	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

List of Programs

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

Total Lecture Hours	**90Hours**

Text Book(s)

1	Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Book(s)

1	Mark Gardner, "Beginning R – The Statistical Programming Language", Wiley, 2013.
2	Robert Knell, "Introductory R: A Beginner‟s Guide to Data Visualisation, Statistical Analysis and programming in R", Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O‟Reilly Media.
3	Garret Grolemund (2014). Hands-on Programming with R. O‟Reilly Media, Inc.
4	Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.
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2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Big Data Analytics	L	T	P	C
Core/elective/Supportive		Core : 9	6	0	0	4
Pre - requisite		None	Syllabus version		2023-24 Onward	

Course Objectives

- To introduce the concept of Big data analytics

Expected Course Outcomes

1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.	**K2**
2	Understand the concepts of Hadoop Distributed file system and hadoop file system interfaces.	**K2**
3	Illustrate the concepts of PIG and HIVE	**K2**
4	Identify the characteristics of datasets and compare the trivial data and big data for various applications.	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction to Data**	**17**

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to InfosphereBigInsights and Big Sheets.

UNIT II	**Introduction to HDFS**	**19**

HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III	**Jobs & Tasks**	**17**

Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

UNIT IV	**Hadoop Eco System Pig**	**18**

Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase :HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

UNIT V	**Data Analytics with R Machine Learning**	**19**

Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Total Lecture Hours	**90**

Text Book(s)

1	Tom White " Hadoop: The Definitive Guide" Third Edit on, O"reily Media, 2012.
2	SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015. References.

3	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4	Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5	Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6	AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
ReferenceBook(s)	
1	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
2	Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
3	Pete Warden, "Big Data Glossary", O"Reily, 2011.
4	Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
5	ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
6	Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO5	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Deep Learning	L	T	P	C
Core/elective/Supportive		Skill Based Subject 3	4	0	0	2
Pre - requisite		None	Syllabus version		2021-22 Onward	

Course Objectives

- To introduce students to the basic concepts and techniques of deep Learning.

Expected Course Outcomes

1	Understand the basic concepts and techniques of Deep Learning.	**K2**
2	To understand and apply the Machine learning principles	**K2**
3	To study the deep learning architectures	**K2**
4	Explore and create deep learning applications with tensor flow	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	**Basics of Neural Network**	**18**
The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Softmax output layers		
UNIT II	**Variables & Operations**	**18**
Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization		
UNIT III	**Basics of CNN**	**19**
Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications		
UNIT IV	**Basics of RNN**	**17**
Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM - Memory augmented Neural Networks – NTM—Application		
UNIT V	**Reinforcement Learning**	**18**
Reinforcement Learning – MDP – Q Learning – Applications		
Total Lecture Hours		**90 Hours**

Text Book(s)

1	Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms", O'ReillyMedia, 2017.

Reference Book(s)

1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive computation and Machine Learning series", MITPress, 2017.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

Course Designed by :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**M**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**S**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**S**	**S**	**S**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Semester - VI

Course Code		Linux and Shell Programming	L	T	P	C
Core/elective/Supportive		Core : 10	6	0	0	4
Pre - requisite		Basic knowledge about Operating Systems	Syllabus version		2023-24 Onward	

Course Objectives

- To introduce the concepts of Linux operating system
- To explain the various constructs associated with Linux

Expected Course Outcomes

1	Illustrate the various directory and fie commands in LINUX	K2
2	Explain the methods of securing files in Linux	K2
3	Explain the various kernel components of Linux	K2
4	Apply the various commands of Linux to perform several operations	K3
5	Solve various network administrative issues by writing Linux shell scripts	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	**Introduction to Linux**	**15**
Introduction to LINUX Operating System: Introduction - The LINUX Operating System - Basic commands in Linux		
UNIT II	**Managing Files & Directories**	**18**
Managing Files and Directories: Introduction – Directory Commands in LINUX – File Commands in LINUX. Creating files using the vi editor: Text editors – The vi editor. Managing Documents: Locating files in LINUX – Standard files – Redirection – Filters – Pipes.		
UNIT III	**Shell script**	**20**
Securing files in LINUX: File access permissions – viewing File access permissions – Changing File access permissions. Automating Tasks using Shell Scripts: Introduction – Variables- Local and Global Shell variables – Command Substitution.		
UNIT IV	**Conditional & Looping Statements**	**19**
Using Conditional Execution in Shell Scripts: Conditional Execution – The case…esac Construct. Managing repetitive tasks using Shell Scripts: Using Iteration in Shell Scripts – The while construct – until construct – for construct – break and continue commands – Simple Programs using Shell Scripts.		
UNIT V	**Kernel & System Recovery**	**18**
Linux Kernel- Kernel Components- compiling a kernel- Customizing a kernel – system startup- Customizing the boot process-System Recovery		
Total Lecture Hours		**90 Hours**

Text Book(s)

1	Operating System LINUX, NIIT, PHI, 2006, Eastern Economy Edition.

Reference Book(S)

1	Richard Petersen, Linux: The Complete Reference, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, Edition 2008.

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	S	M	L	L	L	L	L	L	L
CO5	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low

Course Code		Linux and Shell Programming Lab	L	T	P	C
Core/elective/Supportive		Core Lab: 7	0	0	3	3
Pre - requisite		● Basic knowledge Linux commands	Syllabus version		2023-24 Onward	

Course Objectives

To introduce he concepts of Linux operating system commands execution and various programming construction in Linux shell script.

Expected Course Outcomes

1	To create the directory, how to change and remove the directory.	K1
2	To evaluate the concept of shell scripting programs by using an AWK and SED Commands	K2
3	To demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

EXERCISE 1		**6**
Write a Shell script that displays list of all the files in the current directory to which the user has read, write and execute permissions.		
EXERCISE 2		**6**
Write an awk script to find the number of characters, words and lines in a file?		
EXERCISE 3		**9**
Write a Shell script that accepts a filename, starting and ending line numbers as arguments and displays all the lines between the given line numbers?		
EXERCISE 4		**9**
Write a shell script to sort number in ascending order.		
EXERCISE 5		**12**
Write a shell script (small calculator) that adds, subtracts, multiplies and divides the two given numbers.		
EXERCISE 6		**9**
Write a shell script to determine whether a given number is a prime number or not.		
EXERCISE 7		**12**
Write a shell script to print the first n Fibonacci numbers.		
EXERCISE 8		**9**
Write a shell script to find the GCD of two given numbers.		
EXERCISE 9		**9**
Write a shell script to check whether given string is palindrome or not.		
EXERCISE 10		**9**
Write a shell script to find the factorial of given integer.		
Total Lecture Hours		**90**

Text Book(s)	
1	Operating System LINUX, NIIT, PHI, 2006, Eastern Economy Edition.
Reference Book(S)	
1	Richard Petersen, Linux: The Complete Reference, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, Edition 2008.
Course Designed by :	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Project Work Lab	L	T	P	C
Core/elective/Supportive		Core - 11	0	0	6	4
Pre - requisite		Students should have the strong knowledge in any one of the programming languages in this course.	Syllabus version		2023-24 Onward	

Course Objectives

The main objectives of this course are to:

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.
- Express technical and behavioral ideas and thought in oral settings.
- Prepare and conduct oral presentations

Expected Course Outcomes

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

1	Formulate a real world problem and develop its requirements develop a design solution for a set of requirements	**K3**
2	Test and validate the conformance of the developed prototype against the original requirements of the problem	**K5**
3	Work as a responsible member and possibly a leader of a team in developing software Solutions	**K3**
4	Express technical ideas, strategies and methodologies in written form. Self-learn new tools, algorithms and techniques that contribute to the software solution of the project	**K1-K4**
5	Generate alternative solutions, compare them and select the optimum one	**K6**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.
2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.
3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 200 marks at the last day of the practical session.
2. Out of 200 marks, 160 marks for project report and 40 marks for Viva Voce.

Project Work Format

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of

<Name of the Degree>

of Bharathiar University, Coimbatore-46

College Logo

Signature of the Guide Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

Month – Year

CONTENTS

Acknowledgement

Contents

A. Data Flow Diagram

B. Table Structure

C. Sample Coding

D. Sample Input

E. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**
CO2	**S**	**S**	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**L**	**L**	**L**
CO4	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course Code		Machine Learning	L	T	P	C
Core/elective/Supportive		Skill based subject :4	3	0	0	2
Pre - requisite		None	Syllabus version		2023-24 Onward	

Course Objectives

- To explain about the basics of machine learning

Expected Course Outcomes

1	Understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	K2
2	Understanding of the strengths and weaknesses of many popular machine learning approaches.	K2
3	Explain about the concepts of computational learning theory and dimensionality Reduction	K2
4	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	Introduction to Learning	12

Algorithmic models of learning, Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs for experience. Bayesian, maximum some posterior, and minimum description length frameworks.

UNIT II	Learning Models	12

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

UNIT III	Computational Learning	12

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

UNIT IV	Unsupervised Learning	12

Unsupervised Learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

UNIT V	Learning Applications	12
Selected applications in data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human computer interaction, semantic web, and bioinformatics and computational biology.		
	Total Lecture Hours	**60 Hours**
	Text Book(s)	
1	Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.	
	ReferenceBook(s)	
1	Russel, S. And Norving, P. (2003). Artificial Intelligence: A Modern Approach. 2nd Edition, New York: Prentice-Hall.	
2	Baldi, P., Frasconi, P., Smyth, P. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.	
3	Baldi, P., Frasconi, P., Smyth, P. (2003). Modeling the Internet and the Web – Probabilistic Methods and Algorithms. New York: Wiley.	
4	Bishop, C.M. Neural Networks for pattern recognition. New York: Oxford University press (1995).	
5	Hastie, T., Tibshirani, R., and Friedman, J. (2001). The elements of Statistical Learning – Data mining, Inference, and Prediction, Berlin: Springer- Verlag.	
6	Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.	
7	Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegelhalter. D.J. (1999). Graphical Models and Expert Syatems. Berlin: Springer.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	
Course Designed by :		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO2	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO3	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
CO4	**S**	**S**	**M**	**L**	**L**	**L**	**L**	**L**	**L**	**L**

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