

Progressive Education Society's
Modern College of Arts, Science and Commerce (Autonomous), Shivajinagar, Pune 5

**(An Autonomous College Affiliated to Savitribai Phule Pune
University)**

Framework of Syllabus

For

B. C. A. (Science)

Choice Based Credit System (CBCS)
Syllabus Under National Education
Policy (NEP)

To be implemented from Academic Year 2024-2025

Level:- 4.5 (First Year) Sem:I

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+ (T/P)(2) or T(4)	24CsBcaU1101	Programming in 'C'	2		2		20	30	50
	24CsBcaU1102	Lab Course on 24CsBcaU1101		2		4	20	30	50
Subject 2 T(2)+ (T/P) (2) or T(4)	24CsBcaU1201	Lab Course on Database Management System		2		4	20	30	50
	24CsBcaU1202	Mathematical Foundation		2		4	20	30	50
Subject 3 T(2)+ (T/P)(2) or T(4)	24CsBcaU1301	Project Management I (Software Analysis and Design)	2		2		20	30	50
	24CsBcaU1302	Project Management II (User Interface Design)		2		4	20	30	50
IKS T(2)	24CpCopU1901	Generic IKS	2		2		20	30	50
GE/OE (T/P) (2)	24CsCopU1401	Computer Fundamentals	2		2		20	30	50
SEC (P) (2)	24CsBcaU1601	Lab Course on Statistical Methods		2		4	20	30	50
AEC T(2)	24CpCopU1701 / 24CpCopU1702	MIL-I (Hindi) / MIL-I (Marathi)	2		2		20	30	50
VECT (2)	24CpCopU1801	Environmental Science	2		2		20	30	50
Total			12	10	12	20			550

Level:- 4.5 (First Year) Sem:II

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	ESE	Total
Subject 1 T(2)+ T/P(2) or T(4)	24CsBcaU2101	Advanced Programming in 'C'	2		2		20	30	50
	24CsBcaU2102	Lab Course on 24CsBcaU2101		2		4	20	30	50
Subject 2 T(2)+ T/P(2) or T(4)	24CsBcaU2201	Advanced Database Management System	2		2		20	30	50
	24CsBcaU2202	Lab Course on 24CsBcaU2201		2		4	20	30	50
Subject 3 T(2)+ T/P(2) or T(4)	24CsBcaU2301	Project Management III (SE Practices)	2		2		20	30	50
	24CsBcaU2302	Project Management IV (Case Study : Project Report)		2		4	20	30	50
GE/OE (T/P)(2)	24CsCopU2401	Digital Marketing	2		2		20	30	50
SEC T(2)	24CsBcaU2601	Computer Organization	2		2		20	30	50
AEC T(2)	24CpCopU2703	English Communication Skills I	2		2		20	30	50
VEC T(2)	24CpCopU2801	Democracy, Election and Governance	2		2		20	30	50
CC(2)	24CpCopU2001/ 24CpCopU2011 / 24CpCopU2021 / 24CpCopU2031 / 24CpCopU2041 / 24CpCopU2051 /	Physical Education / Cultural Activities / NSS / NCC / Fine Arts / Applied Arts / Visual Arts / Performing Arts	2		2		20	30	50

	24CpCopU2061 / 24CpCopU2071								
Total			16	06	16	12			550

Level:- 5.0 (Second Year) Sem:III

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsBcaU3101	Data Structure	2		2		20	30	50
	24CsBcaU3102	Object Oriented Programming using CPP	2		2		20	30	50
	24CsBcaU3103	Lab Course on 24CsBcaU3101 & 24CsBcaU3102		2		4	20	30	50
VSC P(2)	24CsBcaU3501	Lab Course on Advanced Spreadsheet Concepts using R Package		2		4	20	30	50
IKS (T/P)(2)	24CsBcaU3901	Vedic Maths and Computer Fundamentals	2		2		20	30	50
FP P(2)	24CsBcaU3002	Field Project I		2		4	20	30	50
Minor (T/P) (2+2 or 4)	24CsBcaU3301	Project Management - V (Object Oriented Software Engineering)	4		4		40	60	100
GE/OE (T/P) (2)	24CsCopU3401	Cyber Security	2		2		20	30	50

AEC T(2)	24CpCopU3703	English Communication Skills II	2		2		20	30	50
CC T(2)	24CpCopU3001	Online Course on Yoga	2		2		20	30	50
Total			16	06	16	12			550

Level:- 5.0 (Second Year) Sem:IV

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	C E	EE	Total
Major Core T(2+2 or 4), (T/P)(2)	24CsBcaU4101	Operating Systems	2		2		20	30	50
	24CsBcaU4102	Programming in Python	2		2		20	30	50
	24CsBcaU4103	Lab Course on 24CsBcaU4101 & 24CsBcaU4102		2		4	20	30	50
VSC P(2)	24CsBcaU4501	Lab Course on Web Technologies-I		2		4	20	30	50
CEP P(2)	24CpCopU4003	Community Engagement Project		2		4	20	30	50
Minor (T/P) (2+2 or 4) GE/OE (T/P) (2) SEC T(2)	24CsBcaU4301	Project Management - VI (Software Project	4		4		40	60	100
	24CsCopU	Management) Web	2		2		20	30	50
	4401	Designing	2		2		20	30	50
	24CsBcaU4601	Introduction to Data Science					20	30	
AEC T(2)	24CpCopU4701 / 24CpCopU47	MIL-II (Hindi) / MIL-II (Marathi)	2		2		20	30	50

	02								
CC T(2)	24CpCopU4001	Health and Wellness	2		2		20	30	50
Total			16	06	16	12			550

Level:- 5.5 (Third Year) Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2or 4 +2+2 or 4 +4) P(2+2 or 4)	24CsBcaU5101	Programming in Java	2		2		20	30	50
	24CsBcaU5102	Server Side Scripting Languages	2		2		20	30	50
	24CsBcaU5103	Advanced Python	2		2		20	30	50
	24CsBcaU5104	Artificial Intelligence	2		2				
	24CsBcaU5105	Lab Course on 24CsBcaU5101		2		4	20	30	50
	24CsBcaU5106	Lab Course on 24CsBcaU5103		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24CsBcaU5201	Data Mining and Data Warehousing	4		4		40	60	100
	24CsBcaU5203	Computer Networks and Cyber Security	4		4		40	60	100
VSC P(2)	24CsBcaU5501	Lab on Web Technologies-II		2		4	20	30	50
FP (2)	24CsBcaU5001	Field Project II		2		4	20	30	50

Minor (T/P) (2)	24CsBcaU530 2	Project Management - VII (Software Testing)	2		2		20	30	50
Total			14	8	14	16			550

Level:- 5.5 (Third Year) Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core T(2+2+2+2 or 4+2+2 or 4+4) P(2+2 or 4)	24CsBcaU610 1	Programming in Advanced Java	2		2		20	30	50
	24CsBcaU610 2	Machine Learning	2		2		20	30	50
	24CsBcaU610 3	Data Analytics	4		4		40	60	100
	24CsBcaU610 4	Lab Course on 24CsBcaU6101		2		4	20	30	50
	24CsBcaU610 5	Lab on Android Programming		2		4	20	30	50
Major Elective (T/P) (2+2 or 4)	24CsBcaU620 1	Database Technologies	2		2		20	30	50
	24CsBcaU620 2	Lab Course on 24CsBcaU6201		2		4	20	30	50
	OR								
	24CsBcaU620 3	Cloud Computing	4	2	4	4	40	60	100
VSC P(2)									
	24CsBcaU 6501	Lab Course on IoT		2		4	20	30	50
OJT (2)	24CsBcaU 6004	On Job Training		4		8	40	60	100

Total			10	12	10	24			550
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**Third Year of BCA (Science)
(NEP 2024)**

Course Code : 24CsBCAU5101

Course Name : Programming in JAVA

Teaching Scheme: 2 Lectures/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem: 30 Marks

Prerequisite:

Basic knowledge of Object Oriented Programming language

Course Objectives:

- To understand the fundamentals of Object-Oriented programming in Java
- To understand the concept and importance of Exception Handling
- To understand basic screen design with Swing
- To understand User Interface Components with Swing
- To understand features of JavaFX

Course outcomes:

On completion of the course, Students will be able to:

CO No.	Course Outcomes(COs)	Blooms Cognitive level
1	Recall and explore the basic syntax of Object Oriented Programming features	1
2	Demonstrate robust application using Core Java features	2
3	Implement basic GUI based application	3
4	Analyse the proficiency in Exception Handling	4
5	Evaluate and develop applications with File handling	5
6	Create interactive applications that leverage user input/output and visual interfaces, combining knowledge of Java and related libraries/frameworks.	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	An Introduction to Java	4
	1.1 Overview of Java Concepts - i What Can Java Do? - ii Characteristics/Buzzwords of Java - iii Advantages and Disadvantages of Java - iv Comparison of Java and C++ - v Java Environment and IDEs 1.2 Java Tools - i jdb (Java Debugger) - ii javap (Class File Disassembler) - iii javadoc (Java Documentation Generator) 1.3 Data Types and Variables 1.4 Operators 1.5 Expressions, Statements, and Blocks 1.6 Control Flow Statements 1.7 Wrapper Classes 1.8 Writing a Simple Java Program	
Unit 2	Usage of Input/ Output and File Handling	3
	2.1 Basic I/O 2.2 Reading Input 2.3 Writing Output 2.4 File Handling	
Unit 3	Objects and Classes	6
	3.1 Defining Your Own Classes 3.2 Access Specifiers (public, protected, private, default) 3.3 Array of Objects 3.4 Constructor, Overloading Constructors and use of 'this' Keyword 3.5 Usage of static block, static fields and static methods 3.6 Inner class, anonymous class 3.7 Garbage Collection	
Unit 4	Inheritance, Abstract class, Interface	4
	4.1 Inheritance Basics - i Understanding the 'extends' Keyword - ii Types of Inheritance 4.2 Usage of final Keyword and Abstract class - i final with Methods - ii final with Classes - iii Abstract Classes and Abstract Methods 4.3 Interfaces	
Unit 5	Exception Handling	5

	5.1 Dealing with Errors and Exceptions i. Understanding Errors vs. Exceptions ii. Common Causes of Exceptions 5.2 Exception Class and Types of Exceptions i. The Exception Class Hierarchy ii. Checked Exceptions iii. Unchecked Exceptions 5.3 Exception Handling Blocks i. try Block ii. catch Block iii. throw Keyword iv. throws Keyword v. finally Block 5.4 creating User-Defined Exceptions 5.5 Defining Custom Exception Classes 5.6 Throwing Custom Exceptions	
Unit 6	User Interface Components with Swing	8
	6.1 Introduction to Swing 6.2 Understanding MVC (Model-View-Controller) Architecture 6.3 Usage of Layout Managers i. FlowLayout ii. BorderLayout 6.4 GridLayout 6.5 Swing Components i. JButton ii. JLabel iii. JTextField iv. JTextArea v. JCheckBox vi. JRadioButton vii. JList viii. JComboBox ix. JMenu and JMenuItem x. JPopupMenu xi. JCheckBoxMenuItem xii. JRadioButtonMenuItem 6.6 Event Handling in Swing 6.7 Event Sources 6.8 Mouse Events 6.9 Keyboard Events 6.10 Event Listeners: ActionListener, MouseListener and MouseMotionListener. KeyListener 6.11 Introduction to JavaFX 6.12 What is JavaFX?	

	6.13 Key Features of JavaFX	
Unit 7	Introduction to JavaFX	
	7.1 What is JavaFX Features of JavaFX Rich UI controls CSS styling Hardware-accelerated graphics JavaFX Architecture High-level architecture Components: Stage Scene Nodes Scene Graph concept 7.2 Structure of a JavaFX program Extending Application class Lifecycle methods: init() start() stop() Writing your first GUI program 7.3. Core Components of JavaFX Stage Primary stage Window properties 7.4 Scene Scene creation Scene graph hierarchy 7.5 Nodes Types of nodes: UI Controls Layout panes Shapes and media	

Reference books:

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt, Tata Mc Graw Hill, ISBN-13 : 978-9390491629
2. Programming with Java | 6th Edition, E Balagurusamy, ISBN-13 : 978-9353162344
3. Core Java: Fundamentals, Volume I, 10th Edition, Cay S. Horstmann, Prentice Hall ISBN-13: 978-0134177304

Reference link: <https://docs.oracle.com/javase/8/>

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**TYBCA (Science)
(2024 Course under NEP)**

**Course Code: 24CsBcaU5102
Course Name: Server-Side Scripting Languages**

**Teaching Scheme: 2 Lectures/Week
Examination Scheme: CIA : 20 Marks**

**Credits: 2
End-Sem : 30 Marks**

Desirable Prerequisites: One must have knowledge of PHP, HTML.

Course Objectives:

- Learn different technologies used at the client-side Scripting Language
- Learn different technologies used at the server-side Scripting Language
- Learn JavaScript to program the behaviour of web pages.
- Learn jQuery to program the behavior of web pages.
- Learn AJAX to make our application more dynamic

Course Outcomes:

CO No.	Course Outcome (CO)	Bloom's Level (BL)
CO1	Understand and apply PHP super globals to handle form data.	1,2,3
CO2	Demonstrate file-handling operations, including reading and writing.	3
CO3	Analyse JSON structure and integrate JSON with PHP for data exchange.	4
CO4	Implement dynamic web pages using JavaScript and manipulate the DOM.	3
CO5	Use jQuery for efficient DOM manipulation and event handling.	3,5
CO6	Develop interactive web applications using AJAX and PHP for data retrieval.	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	Web Techniques	8
1.	1.1 Super Global Variables 1.2 Server information 1.3 Sticky forms 1.4 File Uploads 1.5 Setting response headers 1.6 Maintaining state 1.6.1. Session and Cookies	
Unit 2	Files and Directories	3
	2.1 Working with files and directories 2.2 Opening and Closing 2.3 Getting information about files	
Unit 3	JSON Basics	5
	3.1 Introduction to JSON 3.2 JSON syntax (objects & arrays) 3.3 JSON vs XML 3.4 Encoding: json_encode() 3.5 Decoding: json_decode() 3.6 Sending JSON data from PHP 3.7 Receiving JSON data in PHP	
Unit 4	JavaScript-DHTML	6
	4.1 Overview of JavaScript, DHTML 4.2 Basic Syntax (JS data types, JS variables) 4.3 Primitives, Operations and Expressions 4.4 JS Control Statements 4.5 JavaScript Functions 4.6 JavaScript HTML DOM (onmouseup, onmousedown, onclick, onload, onmouseover, onmouseout)	6.
Unit 5	jQuery	4
	5.1 jQuery Introduction 5.2 Install and Use the jQuery Library 5.3 First jQuery Example 5.4 jQuery Syntax 5.5 Basic Selectors (ID, CLASS)	7.
Unit 6	Ajax	4
	6.1 Understanding JavaScript for AJAX 6.2 Classical AJAX web application model (Using JSON) 6.3 Connecting the database using PHP and AJAX 6.4 Ajax jQuery programs	

Reference books:

1. Programming PHP By Rasmus Lerdorf and Kevin Tatroe O' Reilly publication ISBN: 9781449392772, 3rd Edition
2. Beginning PHP 5, Wrox publication ISBN-10: 0 764557831 ISBN-13: 978-0764557835
3. AJAX Black Book Kogent Solutions ISBN-13978-8177228380
4. Mastering PHP BPB Publication ISBN: 9789387284203
5. Programming the World Wide Web, Robert W Sebesta (4th Edition) ISBN-10: 8131764583 ISBN-13: 978-8131764589
6. jQuery pocket reference by David Flanagan ISBN-10 1449397220
7. Learning jQuery by Jonathan Chaffer ISBN-10: 1849516545 ISBN-13: 978-1849516549
8. JavaScript and jQuery by David Sawyer McFarland ISBN-10 : 1491947071 ISBN-13 : 978-1491947074
9. www.php.net.in
10. www.query.com
11. www.W3schools.com

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T.Y. BCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU5103

Course Name: Advanced Python

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses:

- Knowledge of basic Python programming concepts such as variables, operators, and control structures.
- Understanding of Python data structures including lists, tuples, sets, and dictionaries.
- Familiarity with user-defined functions and modules in Python.
- Basic knowledge of file handling and exception handling mechanisms in Python.
- Understanding of database connectivity using Python with PostgreSQL

Course Objectives:

- To introduce advanced programming concepts in Python.
- To understand Object Oriented Programming using Python.
- To explore Python libraries and modules used in real-world applications.
- To develop small applications using advanced Python concepts.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Understand advanced features of Python programming	1
2	Apply Object Oriented Programming concepts in Python	2
3	Use Python modules and packages for application development	3
4	Implement GUI or API based applications	4
5	Work with external libraries and data processing tools	5
6	Develop real-world Python applications	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	OOP Concepts	06
	1.1 Object Oriented Programming Concepts 1.2 Classes and Objects 1.3 Constructors and Destructors	

	1.4 Encapsulation 1.5 Inheritance and Types of Inheritance 1.6 Polymorphism	
Unit 2	Advanced Python Programming Features	06
	2.1 Iterators 2.2 Generators 2.3 Lambda Functions 2.4 Functional Programming (map(), filter(), reduce()) 2.5 Working with JSON and CSV Files	
Unit 3	Python for Data Processing	06
	3.1 Introduction to NumPy 3.2 NumPy arrays and operations 3.3 Introduction to Pandas 3.4 DataFrame operations 3.5 Reading and writing datasets	
Unit 4	GUI Programming in Python	06
	4.1 Introduction to GUI Programming 4.2 Tkinter Basics 4.3 Creating Windows, Labels, Buttons 4.4 Event Handling in Tkinter 4.5 Developing simple GUI applications	
Unit 5	Database Programming with Python	06
	5.1 Introduction to Database Programming in Python 5.2 Python Database API (DB-API) 5.3 Connecting Python with Databases using SQLite / PostgreSQL 5.4 Executing SQL Queries (SELECT, INSERT, UPDATE, DELETE) using Python 5.5 Integrating Database Operations with Tkinter GUI Applications	

Reference Books:

1. *Learning Python* — Mark Lutz — O'Reilly Media — ISBN-13: 978-1449355739
2. *Fluent Python (2nd Edition)* — Luciano Ramalho — O'Reilly Media — ISBN-13: 978-1492056355
3. *Python Crash Course (2nd Edition)* — Eric Matthes — No Starch Press — ISBN-13: 978-1593279288
4. *Automate the Boring Stuff with Python (2nd Edition)* — Al Sweigart — No Starch Press — ISBN-13: 978-1593279929

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**Third Year of BCA (Science)
(NEP 2024)**

Course Code: 24CsBcaU5104

Course Name: Artificial Intelligence

Teaching Scheme: TH: 02 Hours/Week

Credit: 02

Examination Scheme: CIA : 20 Marks

End-Sem: 30 Marks

Prerequisites:

- Data Structure and Algorithm.
- Discrete mathematics.

Course Objectives:

- To understand the concept of Artificial Intelligence (AI) in the form of various tasks.
- To understand Problem Solving using various searching strategies for AI.
- To acquaint with the fundamentals of knowledge and reasoning.
- To understand Fundamentals of Game Theory.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Understand the fundamental concepts of Artificial Intelligence.	1
2	Identify and apply appropriate search strategies Artificial Intelligence for AI problem.	2
3	Implement simple AI algorithms such as search algorithms or machine learning models.	3
4	Apply knowledge representation methods and reasoning techniques in AI problems.	4
5	Analyze different AI approaches and compare their performance in solving real-world problems	5
6	Understand Fundamentals of Game Theory.	2

Course Contents:

Unit No.	Title	Lectures
Unit 1	Introduction to Artificial Intelligence	3 lectures
	1.1 Introduction to AI 1.2 History of AI 1.3 Advantages and Disadvantages of AI	

	1.4 Applications of AI	
Unit 2	Problem Solving	8 lectures
	2.1 Problem Space 2.2 Solving Problems by Searching 2.3 Heuristic Search Techniques 2.4 Constraint Satisfaction Problems (A* Algorithm, AO* Algorithm)	
Unit 3	Heuristic Search Techniques	8 lectures
	3.1 Generate-and-test 3.2 Hill Climbing 3.3 Best First Search 3.4 Mean-Ends Analysis	
Unit 4	Knowledge and Reasoning	7 lectures
	4.1 Representations and Mappings 4.2 Logical Agents 4.3 Logic, Propositional Logic, First order logic 4.4 Knowledge representation -Production based 4.5 system, Frame based system 4.6 Inference – Backward chaining, Forward chaining	
Unit 5	Gaming Planning and Learning	4 lectures
	5.1 Minmax, Alpha-beta Pruning. 5.2 Overview of different forms of learning 5.3 Limitations of Game Search Algorithms	

References:

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901
3. Artificial Intelligence, Elaine Rich and Kevin Knight ,Tata McGraw Hill, 2nd Edition –. ISBN: 9780070522633
4. Introduction to Artificial Intelligence and Expert System, Dan Patterson Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing .ISBN: 9788120320413
5. Artificial Intelligence: A Modern Approach, 3rd Edition – Stuart Russell and Peter Norvig. ISBN: 9780136042594
6. Artificial Intelligence – Deepak Khemani, Tata McGraw Hill Education, 2013. ISBN: 9780070683709

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**Third Year of B.Sc. (Computer Science)
(NEP 2024)**

Course Code : 24CsBCAU5105

Course Name: Lab Course on 24CsBCAU5101

Teaching Scheme: 4 Hours/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem: 30 Marks

Course Objective:

To understand the process of designing and implementing applications with Core Java features.

Sr. No.	Assignment Name
1.	Simple Java programs and File handling
2.	Objects, Classes and Packages
3.	Inheritance and Interfaces
4.	Exception Handling
5.	Strings, Streams, I/O and File Handling
6.	Usage of Swing components and Event Handling
7.	Application with JavaFX

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T.Y. BCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU5106

Course Name: Lab Course on 24CsBcaU5103

Teaching Scheme: PR : 4 Hours/Week

Credit : 02

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses:

- Knowledge of basic Python programming concepts such as variables, data types, operators, and control structures.
- Understanding of Python data structures, functions, file handling, and basic database connectivity.

Course Objectives:

- To introduce advanced programming concepts such as Object Oriented Programming in Python.
- To understand advanced Python features including iterators, generators, lambda functions, and functional programming techniques.
- To develop data processing skills using Python libraries such as NumPy and Pandas.
- To design graphical user interface (GUI) applications using the Tkinter module.
- To implement database connectivity and perform CRUD operations using Python.

Course Contents:

Sr.No	List of Assignments
1	To create a class Student with attributes (roll_no, name, marks) and display the details using objects.
2	To demonstrate constructor and destructor using a class Employee.
3	To demonstrate inheritance by creating a base class Person and derived class Student.
4	To demonstrate iterators using iter() and next() functions.
5	To create a generator function that generates the Fibonacci series.
6	Using lambda functions to perform arithmetic operations.
7	To demonstrate map(), filter(), reduce() functions on a list of numbers.
8	To create NumPy arrays and perform basic operations such as addition, subtraction, and multiplication.
9	To demonstrate NumPy array indexing and slicing.
10	Using Pandas DataFrame to store student data and display selected columns.
11	Create a Tkinter GUI window with labels and buttons.
12	Create a simple calculator GUI using Tkinter.
13	Develop a Tkinter form application to accept user input (name, age, address) and display it on the screen.

14	To connect Python with SQLite / PostgreSQL database and create a table.
15	Create a Tkinter based GUI application to perform CRUD operations (Insert, Update, Delete, Display) on a database table.

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**TYBCA (Science)
(2024 Course under NEP)**

Course Code: 24CsBcaU5201

Course Name: Data Mining and Data Warehousing

Teaching Scheme: TH: 4 Hours/Week

Credit: 04

Examination Scheme: CIA: 40 Marks

End-Sem: 60 Marks

Prerequisite Courses:

- Understand the concepts of Data science
- Revise the methodologies used for analysis of data
- Describe various techniques which enhance the data modelling.

Course Objectives:

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

Course Outcomes:

After successful completion of this course, students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Define the functionality of the various data mining and data warehousing component	1
2	Explain schema types of dimensional data modelling.	2
3	Apply appropriate classification, clustering techniques for data analysis	3
4	Discover interesting patterns from large amounts of data to analyze for predictions and classification.	4
5	Compare different approaches of data warehousing and data mining with various technologies.	5
6	Design a Data warehouse system and perform business analysis with OLAP tools.	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	Introduction to Data Mining	8 lectures
	1.1 Definition : Data mining , KDD 1.2 Stages of the Data Mining Process (KDD) 1.3 Data Mining Techniques/Tasks 1.4 Knowledge Representation Methods 1.5 Applications of Data mining 1.6 Data Mining issue	
Unit 2	Data Preprocessing	10 lectures
	2.1 Data Cleaning 2.2 Data Integration 2.3 Data Transformation 2.4 Data Reduction 2.5 Data Discretization 2.6 Handling Missing Values & Noisy Data	
Unit 3	Data Warehousing & OLAP	10 lectures
	3.1 Introduction to Data Warehouse , Data Mart 3.2 Data Warehouse Architecture and its components 3.3 Introduction to OLAP AND OLTP 3.4 Data Modeling with OLAP i. Difference between OLTP and OLAP ii. OLAP Operations (Roll-up, Drill-down, Slice, Dice) iii. Fact Table, Dimension Table, OLAP cube iv. Introduction Star Schema, Snowflake Schema, Fact Constellation	
Unit 4	Classification	14 lectures
	4.1 Definition of Supervised Learning 4.2 Definition of Classification 4.3 General Approaches to solving a classification problem 4.4 Overview of Classification techniques 4.5 Classification Process & Workflow 4.6 Types of Classification Tasks i. Introduction to Decision Trees ii. Decision Construction iii. Algorithm for Decision tree iv. Tree Pruning : Pre-Pruning , Post-Pruning Measures for Selecting the Best Split	

	4.7 Attribute Selection Measures i. Entropy ii. Information Gain iii. Gain Ratio iv. Gini Index v. Comparison of attribute selection measures vi. Classification vs Prediction vii. Prediction: Accuracy and Error measures 4.8 Real-World Applications	
Unit 5	Clustering	12 lectures
	5.1 Definition of Unsupervised Learning 5.2 Cluster Analysis i. Introduction to Unsupervised Learning ii. Requirements for Cluster Analysis. iii. Problems faced in clustering 5.3 Hierarchical Methods i. Agglomerative Hierarchical Clustering ii. Divisive Hierarchical Clustering 5.4 Partitioning Methods i. k-Means: A Centroid-Based Technique ii. k-Medoids: A Representative Object-Based Technique 5.5 Clustering Concepts 5.6 Real-World Applications	
Unit 6	Mining Complex Data Types and Applications	8 lectures
	6.1 Web Mining 6.2 Text Mining 6.3 Spatial & Temporal Data Mining 6.4 Multimedia Mining	

Reference Books:

1. Tan, Pang-Ning; Steinbach, Michael; Kumar, Vipin. Introduction to Data Mining, Pearson Education. ISBN: 9780321321367
2. Han, Jiawei and Kamber, Micheline. Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers. ISBN: 9780123814791
3. Dunham, Margaret H. and Sridhar, S. Data Mining: Introductory and Advanced Topics, Pearson Education. ISBN: 9780130888921
4. Gupta, S. C. Fundamentals of Statistics, Sultan Chand & Sons, New Delhi. ISBN: 9788183183390
5. Elhance, D. N. Fundamentals of Statistics, Kitab Mahal Publishers, New Delhi. ISBN: 9788122500332
6. Han, Jiawei; Kamber, Micheline; Pei, Jian. Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers. ISBN: 9780123814791

7. Adriaans, Pieter and Zantinge, Dolf. Data Mining, Addison-Wesley / Pearson Education.
ISBN: 9780201403756
8. Anahory, Sam and Murray, Dennis. Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems, Addison-Wesley Professional.
ISBN: 9780201188042
9. The Data Warehouse Toolkit - Ralph Kimball, Margy Ross Amir D Aczel, Jayavel Sounderpandian - Complete Business statistics, ISBN-13: 978-0077108601

Progressive Education Society's
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Third Year of B.C.A. (Science)
(NEP 2024)

Course Code: 24CsBcaU5203

Course Name: Computer Networks and Cyber Security

Teaching Scheme: 4 Lectures/Week

Credits: 4

Examination Scheme: CIA: 40 Marks

End-Sem: 60 Marks

Prerequisite:

- Basic knowledge of networking concepts is required.

Course Objectives:

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to cyber security concepts, preparing the student for Advanced courses in computer networking.

Course Outcomes:

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

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Recognize the basic computer network technology and understand the cyber security concepts.	1
2	Demonstrate Data Communications System and its components.	2,3
3	Discover the different types of network topologies and protocols.	4,5,6
4	Explain the layers of the OSI model, TCP/IP and the function(s) of each layer.	4,6
5	Explain the different types of network devices and their functions within a network.	5,6
6	Building the skills of subnetting and routing mechanisms.	6

Course Contents

Unit No.	Title	Lectures
1	An Introduction to Networks, Network Topologies and Types	9
	1.1. Data communications and representation Information Exchange, Sharing, preserving & protecting. 1.2. Hardware and Software Resource Sharing 1.3. Computer Networks-Goals and applications –Business Application, Home Application, Mobile User, Social Issues 1.4. Network Hardware -Broadcast and point-to-point 1.5. Network Topologies (Bus, Star, Ring, Star Bus, Mesh) 1.6. Network Types- LAN, MAN, WAN, PAN, Wireless Networks, Home Networks, Internetwork	
2	Network Models	5
	2.1. OSI Reference Model Functionality of each layer 2.2. TCP/IP Reference Model 2.3. Addressing Physical, Logical and Port addresses	
3	Physical Layer	12
	3.1. Performance of the Network Bandwidth, Throughput, Latency (Delay), Bandwidth – Delay Product, Jitter 3.2. Transmission Modes, Parallel Transmission and Serial Transmission– Asynchronous and Synchronous and Isochronous 3.3. Switching-Circuit Switching, Message Switching and Packet Switching 3.4. Physical Layer Devices: Repeaters, Hubs-active hub Passive hub 3.5. DSSS/FHSS	
4	Data Link Layer	8
	4.1. Design Issues–Services provided to the Network Layer, Framing– Concept, Methods–Character Count, Flag bytes with Byte Stuffing, Starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations, Flow and Error Control 4.2. Error detection code CRC 4.3. Random Access Protocols ALOHA– pure and slotted, CSMA- 1- persistent, p-persistent and non-persistent CSMA/CD, CSMA/CA, CDMA 4.4. Controlled Access Reservation, Polling and Token Passing concept	
5	Network Layer	10
	5.1. IPv4 addresses: address space, Classful addressing, Classless addressing, NAT 5.2. IPv4: Datagram, Fragmentation, checksum, option	
6	Transport Layer	10
	6.1. User Datagram Protocol(UDP) Datagram Format, Checksum, UDP operations, Use of UDP 6.2. . Transmission Control Protocol (TCP) TCP Services –Process to-Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments, Full –Duplex Communication, Connection oriented service, Reliable service.	

	6.3. TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control 6.4. TCP Segment Format 6.5. SSL/TLS 6.6. TCP Improvements (Indirect TCP, Snooping TCP, Mobile TCP)	
7	Introduction to Cyber Security	6
	7.1. Introduction 7.2. Need for security. 7.3. Principles of Security 7.4. Types of Attacks 7.5. Cryptography 7.6. Plaintext and Cipher Text 7.7. Cyber security categories 7.7.1 Network Security 7.7.2 Application Security 7.7.3 Information Security 7.7.4 Operational Security	

Reference books:

1. Computer Networks by Andrew Tanenbaum ,Pearson Education 4th Edition , ISBN 10:0130661023 / ISBN 13:9780130661029
2. Data Communication and Networking by Behrouz Forouzan , TATA McGraw Hill 4th Edition , ISBN:9780070634145, 0070634145
3. Networking All In One Dummies by Doug Lowe ,Wiley Publication ,7th Edition, ISBN – 13: 987-0764575839,ISBN – 10 : 076457583X
- 4 Cryptography and Network Security by Atul Kahate, 4th Edition, Tata McGraw Hill ISBN : 9781259029882, 978-1259029882

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TYBCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU5501

Course Name: Lab on Web Technologies-II

Teaching Scheme: 4 Hours/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Desirable Prerequisites: One must have knowledge of PHP, HTML.

Sr.No.	Title of the assignment
1.	Super global Variable, Sticky Form, Session, Cookies
2.	Files and Directories
3.	XML
4.	JavaScript
5.	jQuery
6.	AJAX Ajax with database connectivity Ajax jQuery

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TYBCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU5302 Course Name: Project Management VII (Software Testing)

Teaching Scheme: 2 Lectures/Week

Credits: 2

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Desirable Prerequisites:

- Knowledge of Software Engineering

Course Objectives:

- To introduce testing concepts and evolution
- To discuss the levels of testing
- To explain various types of testing
- To discuss the different testing techniques

Course Outcomes:

CO No.	Course Outcome	Blooms cognitive Level
1	Define software testing process & list principles	1
2	Classify Levels of testing	2
3	Organize different types of Testing	3
4	Analyse appropriate testing techniques	4
5	Determine the role of tester & test manager	5
6	Choose appropriate testing tools	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	Fundamentals of Testing	4
	1.1 Definition of software testing i. Objectives of testing ii. Testing and Debugging 1.2 Necessity of Software Testing i. Error, Bug, fault, defect and failure 1.3 Seven Testing Principles	
	1.4 Testing Process (STLC)	
Unit 2	Software Development Life Cycle	2
	2.1 SDLC Models- Waterfall Model, V Model	
	2.2 Agile Testing – Test driven software development	
	2.3 Levels of Testing	

	i. Unit Testing ii. Integration Testing iii. System Testing iv. Acceptance Testing	
Unit 3	Types of Testing	5
	3.1 Functional Testing (Black box) 3.2 Non-Functional Testing i. Performance, Usability testing ii. Portability, security testing 3.3 Structural (White-Box) Testing 3.4 Change related testing i. Re-testing & regression Testing	
Unit 4	Static Testing and Dynamic Testing	4
	4.1 Difference Between Static and Dynamic Testing 4.2 Static Testing techniques - Review i. Review Process ii. Roles and Responsibilities in formal review iii. Review Types 4.3 Static Testing techniques - Static Analysis	
Unit 5	Testing Techniques	7
	5.1 Categories of Testing Techniques 5.2 Black Box Testing Techniques i. Equivalence Partitioning ii. Boundary Value Analysis iii. Decision Table Testing iv. State Transition Testing v. Use case Testing 5.3 White-Box Testing Techniques i. Statement Testing and coverage ii. Decision Testing and Coverage 5.4 Experience based Testing Techniques i. Error Guessing ii. Exploratory Testing iii. Checklist based Testing	
Unit 6	Test Management	4
	6.1 Test Organization i. Independent Testing ii. Tasks of Test manager and tester 6.2 Test Planning and Estimation 6.3 Test progress monitoring and control 6.4 Configuration management 6.5 Risk and Testing i. Project risk and Product risk 6.6 Defect management	

	i. Defect Life Cycle	
Unit 7	Introduction to Automation Testing	1
	7.1 Definition of Automation Testing 7.2 Benefits of Automation Testing	
Unit 8	Tools Support for Testing	3
	8.1 Types of Test tools – CAST (only type & 8.2 their purpose) 8.3 Effective use of tool (Benefits and Risks) 8.4 Introduction of a tool into an organization (e.g. Selenium)	

Reference books:

1. Lessons Learned in Software Testing: By [Cem Kaner](#) , [James Bach](#), Bret Pettichord, paperback publication ISBN 9781283294928
2. Software Testing by Ron Patton, Lisa Crispin, Janet Gregory, 1st edition, paperback publication ISBN-13978-0321534460
3. Agile Testing: A Practical Guide for Testers and Agile Teams, by Lisa Crispin and Janet Gregory, paperback publication ISBN: 978-1847940933
4. Foundations of Software Testing (ISTQB certification), Dorothy Graham, Erik van Veenendaal ,Isabel Evans ,Rex Black ISBN-13 978-1844809899

SEM-VI

**Progressive Education Society's
Modern College of Arts, Science and Commerce(Autonomous),
Shivajinagar, Pune - 5**

**Third Year of B.Sc. (Computer Science)
(NEP 2024)**

Course Code : 24CsBcaU6101

Course Name : Programming in Advanced JAVA

Teaching Scheme: 2 Hours/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem: 30 Marks

Desirable Prerequisites: Knowledge of Core Java

Course Objectives:

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- To learn socket programming for developing Client-Server applications

Course Outcomes:

On completion of the course, Students will be able to:

CO No	Course Outcomes(COs)	Blooms Cognitive level
1	Recall and define advanced Java concepts such as multithreading, networking, Java database connectivity (JDBC)	1
2	Illustrate the use of multithreading, concurrency, and synchronization mechanisms in Java applications.	2
3	Apply JDBC to connect to a database and perform CRUD operations (Create, Read, Update, Delete).	3
4	Break down software requirements and determine how to implement solutions using design patterns, advanced Java features, and frameworks.	4
5	Evaluate database design decisions and recommend improvements in the context of performance, maintainability, and scalability.	5
6	Design and implement advanced Java applications that integrate multiple technologies (e.g., multi-threading, database, networking, and GUI).	6

Course Contents

Unit No.	Title	Lectures
Unit 1	Collections	6
	1.1 Introduction to the Collection Framework i. Overview of Collections in Java ii. Benefits of Using Collections iii. Collection Framework Hierarchy 1.2 List Interface i. ArrayList ii. LinkedList iii. Vector iv. Stack v. Queue 1.3 Set Interface i. HashSet ii. TreeSet iii. LinkedHashSet 1.4 Important Interfaces in Collections i. Comparator Interface 1.5 Iterator Interface i. ListIterator Interface ii. Enumeration Interface	
Unit 2	Database Programming	6
	2.1 Introduction to JDBC and Architecture i. What is JDBC? ii. Features of JDBC iii. JDBC Architecture and Component iv. Types of JDBC Drivers 2.2 Processing SQL Statements with JDBC i. Establishing a Connection ii. Executing SQL Queries (Statement, PreparedStatement, CallableStatement) iii. Handling ResultSet and Retrieving Data iv. Updating and Deleting Records Using JDBC	
Unit 3	Servlet	6
	3.1 Introduction to Servlet 3.2 Servlet life cycle 3.3 Handling of Request and Response 3.4 Session tracking i. User Authorization ii. URL Rewriting iii. Hidden form fields iv. Cookies	

Unit 4	Java Server Pages	6
	4.1 Introduction to JSP - What is JSP? - Features and Advantages of JSP - Difference Between JSP and Servlets - JSP Lifecycle - Implicit Objects 4.2 Scripting Elements - Declarations (<%! %>) - Expressions (<%= %>) - Scriptlets (<% %>) - Comments (<%-- --%>) 4.1 JSP Directives - Page Directive (<%@ page %>) - Include Directive (<%@ include %>) - Simple JSP Program	
Unit 5	Multithreading	3
	5.1 What are threads? 5.2 Thread Lifecycle 5.3 Usage of Thread class / Runnable Interface 5.4 Thread Priorities	
Unit 6	Introduction to Frameworks	3
	6.1 Spring Framework - Introduction to Spring Framework and Beans - Understanding Dependency Injection - Spring Applications and Configuration - Overview of Spring MVC Framework 6.2 Introduction to Components of Hibernate - What is Hibernate? - Hibernate Architecture and Components - Hibernate ORM and Persistence 6.3 Introduction to Struts Framework - Overview of Struts Framework - Features and Advantages of Struts - Struts MVC Architecture 6.4 Introduction to Maven Framework - What is Maven? - Maven Project Structure and Build Lifecycle - Understanding MOJO (Maven Plain Old Java Object) - Understanding POJO (Plain Old Java Object)	

References Books:

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt, Tata Mc Graw Hill, ISBN-13 : 978-9390491629
2. Programming with Java 6th Edition, E Balagurusamy, ISBN-13 : 978-9353162344

3. Core Java, Volume II—Advanced Features, Tenth Edition, Pearson publication, ISBN-13 : 978-0134177298
4. Getting started with Spring Framework: covers Spring 5 by J Sharma and Ashish Sarin, ISBN-13 : 978-1979962780
5. Spring 4 for Developing Enterprise Applications: An End-to-End Approach by Henry H.Liu, ISBN-13 : 978-0615639451

Reference link:

<https://docs.oracle.com/javase/8/>

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**TYBCA (Science) Sem-VI
(2024 Course under NEP)**

Course Code: 24CsBcaU6102

Course Name: Machine Learning

Teaching Scheme: 2 Lectures/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem : 30 Marks

Desirable Prerequisites: One must have knowledge of Basic concepts of Statistics, Linear Algebra basics, a Basic understanding of database concepts and data handling.

Course Objectives:

- To understand human learning aspects
- To understand concepts, techniques of machine learning
- To apply machine learning techniques for problem-solving
- To use tools and techniques for understanding the concept of machine learning

Course Outcomes:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	• Define key concepts in machine learning • List various machine learning algorithms • Identify trends in machine learning	1
2	• Explain the differences between supervised and unsupervised learning. • Summarises how key algorithms like linear regression and classification models work. • Classify different types of machine learning problems (classification, regression, clustering).	2
3	• Use cross-validation and regularisation techniques to improve model performance.	3
4	• Analyse the performance of machine learning models using evaluation metrics like precision, recall, and F1 score. • Compare the performance of different algorithms	4
5	• Evaluate the effectiveness of various models in solving real-world problems by comparing their accuracy and computational efficiency.	5
6	• Design and build end-to-end machine learning pipelines, from data preprocessing to model selection and evaluation.	6

Course Contents:

Unit No.	Title	Lectures
Unit 1	Introduction to Machine Learning	6
	1.1 What is Machine Learning? 1.2 Need and Applications of Machine Learning 1.3 Types of Machine Learning 1.4 Machine Learning Process i. Data Collection ii. Data Preprocessing iii. Training and Testing iv. Model Evaluation 1.5 Challenges in Machine Learning	
Unit 2	Supervised Learning – Regression	8
	2.1 Introduction to Regression 2.2 Simple Linear Regression 2.3 Multiple Linear Regression 2.4 Assumptions of Linear Regression (Basic Concept) 2.5 Evaluation Metrics i. Mean Absolute Error (MAE) ii. Mean Squared Error (MSE) iii. R^2 Score 2.6 Applications of Regression	
Unit 3	Supervised Learning – Classification	8
	3.1 Introduction to Classification 3.2 Logistic Regression 3.3 K-Nearest Neighbors (KNN) 3.4 Decision Tree 3.5 Naïve Bayes 3.6 Evaluation of Classification Models i. Confusion Matrix ii. Accuracy iii. Precision iv. Recall v. F1 Score	
Unit 4	Unsupervised Learning and Model Improvement	8

	4.1 Introduction to Unsupervised Learning 4.2 Clustering i. K-Means Clustering ii. Hierarchical Clustering 4.2 Introduction to Dimensionality Reduction: Concept of Principal Component Analysis (PCA) 4.4 Overfitting and Underfitting 4.5 Bias–Variance Tradeoff 4.6 Cross Validation	
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Reference Books

1. Pat Langley, *Elements of Machine Learning*, Morgan Kaufmann Publishers. ISBN-13: 978-1558603011
2. William W. Hsieh, *Machine Learning Methods in the Environmental Sciences: Neural Networks and Kernels*, Cambridge University Press. ISBN 10: 1108456901 / ISBN 13: 9781108456906.
3. Jiawei Han, Micheline Kamber, and Jian Pei, *Data Mining: Concepts and Techniques*, Morgan Kaufmann Publishers (Elsevier). ISBN-10. 9780128117606 · ISBN-13. 978-0128117606
4. Peter Harrington, *Machine Learning in Action*, DreamTech Press (Elsevier India). ISBN-13 978-9350044131, ISBN-10 9350044137

Text Books

1. Mitchell, Tom M. *Machine Learning*, McGraw-Hill Education. ISBN: 9780070428072
2. Alpaydin, Ethem. *Introduction to Machine Learning*, MIT Press. ISBN: 9780262028189
3. Marsland, Stephen. *Machine Learning: An Algorithmic Perspective*, CRC Press, Taylor & Francis Group. ISBN: 9781466583283
4. Bishop, Christopher M. *Pattern Recognition and Machine Learning*, Springer. ISBN: 9780387310732

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Third Year of B.C.A. (Science)
(Course under NEP 2024)

Course Code :24CsBcaU6103

Teaching Scheme: TH: 4Hours/ Week

Examination Scheme: CIA: 40 Marks

Course Name: Data Analytics

Credits: 04

End-Sem: 60 Marks

Prerequisites:

- Knowledge of probability theory, statistics and programming

Course Objectives:

- Able to apply fundamental algorithmic ideas to process data
- Learn to apply hypotheses and data into actionable Predictions
- To understand Data Analytics Life Cycle and Business Challenges

Course Outcomes:

After successful completion of this course students will able to :

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Understand Data science process	1
2	Understand Basics of Data Analytics and Types of Analytics	2
3	Apply the concepts of Data processing	3
4	Deploying the Data Analytics Lifecycle in data analytics projects	4
5	Selecting appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences	5
6	Apply Big Data Analytics techniques in a Case study and also use Hadoop valuate the scalability and performance of Big Data analytics solutions	6

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Introduction to Data Analytics	10
	1.1 Introduction to Data Analytics Definition, importance, evolution Role of data analytics in decision making 1.2 Types of Analytics Descriptive, Diagnostic, Predictive, Prescriptive 1.3 Data Analytics Lifecycle Business understanding, data understanding, preparation, modelling, evaluation, deployment 1.4 Applications of Data Analytics Healthcare, finance, marketing, agriculture, climate studies 1.5 Challenges and Ethics in Data Analytics Data privacy, security, bias, ethical issues, Case Study Discussion	
Unit 2	Data Types and Data Collection	8
	2.1 Types of Data- Structured, semi-structured, unstructured 2.2 Data Sources- Databases, data warehouses, web data, sensors, APIs 2.3 Data Collection Techniques- Surveys, experiments, logs, web scraping 2.4 Introduction to Open Data - Government and international data sources 2.5 Data Quality Issues- Missing data, noise, inconsistency 2.6 Practical: Identifying Data Sources & Quality Checks	
Unit 3	Data Preprocessing and Data Wrangling	8
	3.1. Data Cleaning- Handling missing values and outliers 3.2. Data Transformation - Normalization, standardization 3.3. Data Integration - Merging datasets, schema integration 3.4. Data Reduction - Dimensionality reduction, sampling 3.5. Feature Engineering - Feature selection and extraction 3.6. Tools for Data Preprocessing - Python (NumPy, Pandas) 3.7. Feature Engineering Case Study	
Unit 4	Exploratory Data Analysis (EDA)	8
	4.1. Introduction to EDA 4.2. Descriptive Statistics - Mean, median, variance, standard deviation 4.3. Data Distribution and Probability Concepts 4.4. Data Visualization Techniques - Bar chart, histogram, box plot 4.5. Advanced Visualization - Scatter plots, heatmaps 4.6. Tools for Visualization - Matplotlib, Seaborn 4.7. Mini Case Study using EDA	
Unit 5	Statistical Analysis for Data Analytics	7
	5.1. Basics of Statistical Analysis 5.2. Correlation and Covariance	

	5.3. Probability Distributions - Normal, Binomial, Poisson 5.4. Hypothesis Testing - Null & alternative hypothesis 5.4. Parametric Tests - t-test, z-test, ANOVA 5.5. Non-Parametric Tests 5.6. Statistical Analysis using Python 5.7. Case Study Interpretation	
Unit6	Introduction to Big Data Analytics	8
	6.1. Introduction to Big Data Analytics 6.2. Definition and characteristics of Big Data 6.3. Challenges in Big Data analytics 6.4. Introduction to popular Big Data platforms and tools 6.5. Sources of Big Data 6.6. 3V's of Big Data (need for Hadoop) 6.7. Varying data structures 6.8. Applications of Big Data	
Unit7	Data Processing in Big Data Analytics & Hadoop Ecosystem	10
	7.1. Data Processing in Big Data Analytics & Hadoop Ecosystem 7.2. Data ingestion and storage (Hadoop Distributed File System, NoSQL databases) 7.3. Batch processing vs. real-time stream processing 7.4. Introduction to Hadoop 7.5. Hadoop Architecture 7.6. History of Hadoop-Facebook, Dynamo, Yahoo, Google 7.7. Hadoop Components :HDFS, MapReduce 7.8. Introduction to Pig, Hive, HBase , Mahout Apache spark 7.9. Installation of single node cluster-installation of java 7.10. Hadoop configuration	
Unit8	Experiential Learning	1
	Apply Data Analytics techniques in a Case study and also evaluate the scalability and performance of Big Data analytics solutions use Visualization techniques	

Reference Books:

1. Developing Analytic Talent: Becoming a Data Scientist, Vincent Granville, wiley, 2014
ISBN-10: 1118810082, ISBN-13: 978-1118810088
2. Stanton, Jeffrey and De Graaf, Robert. Introduction to Data Science, Version 2.0, 2013, Syracuse University Open Textbook, ISBN: 9781312810464
3. Big Data, Black Book-Covers Hadoop2, MapReduce, Hive, YARN, Pig, R and Data Visualization” Dreamtech Press,(2015).
4. Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung The Google File System
5. <http://wiki.apache.org/hadoop/>
6. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
7. 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”, McGrawHill/Osborne Media (2013), Oracle pres

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Third Year of B.C.A. (Science)
(Course under NEP 2024)

Course Code : 24CsBcaU6104

Course Name : Lab Course on 24CsBcaU6101

Teaching Scheme: 2 Hours/Week

Credits: 2

Examination Scheme: CIA : 20 Marks

End-Sem: 30 Marks

Course Objective :

- To learn database programming using Java
- To study web development concept using Servlet and JSP
- Understand the fundamental concepts and functionality of simulators in computing systems.
- Understand the role of an assembler in translating assembly language to machine language
- Develop skills in creating DFA drivers that simulate the execution of DFA models for practical language recognition tasks

Sr. No.	Assignment Name
1.	Collections
2.	Java Database Connectivity
3.	Servlets
4.	Java Server Pages
5.	Multithreading

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T.Y. BCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU6105

Course Name: Lab on Android Programming

Teaching Scheme: PR : 4 Hours/Week

Credit : 02

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses:

- Basic knowledge of programming (preferably Java).
- Familiarity with object-oriented programming concepts.

Course Objectives:

- To introduce students to the fundamentals of Android app development.
- To build the skills necessary to design and develop Android applications.
- To familiarize students with Android tools, including Android Studio and essential libraries.

Course Contents:

Sr.No	List of Assignments
1	Installation and setup of Android Studio and creation of a basic Android project.
2	Development of a Hello World Android application and understanding the project structure (Manifest, resources, Java files).
3	Exploration of Android Studio interface and creation of a simple application with TextView and Button.
4	Design an application using TextView, EditText, and Button to display user-entered text on the screen.
5	Create an application demonstrating different layout types such as LinearLayout, RelativeLayout, and ConstraintLayout.
6	Design a simple login interface using XML layouts with EditText and Button.
7	Develop an application demonstrating the Activity Lifecycle methods using Toast or Log messages.
8	Create an application using Explicit Intent to navigate from one activity to another.
9	Develop an application demonstrating Implicit Intent to open a browser or dialer.
10	To create an Android app that performs addition, factorial calculation, sum of digits, Armstrong number check, reverse number, and palindrome number check.
11	Implement Button click event handling to display a Toast message.

12	Create an application that handles user input events using EditText and Button.
13	Create an application demonstrating the Fragment lifecycle.
14	Develop an application that adds and replaces fragments within an Activity.
15	Develop an application demonstrating multiple event listeners for different UI components.

Reference Books:

1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips, Chris Stewart, and Kristin Marsicano ISBN-13: 978-0134706054,
2. "Android Development for Beginners: Learn to Build Android Apps" by Google Developers ISBN-13: 978-0991391134
3. "Head First Android Development: A Brain-Friendly Guide" by Dawn Griffiths and David Griffiths ISBN-13: 978-1491974050
4. "Professional Android" by Reto Meier and Ian Lake ISBN-13: 978-1118779607
5. "Android Cookbook: Problems and Solutions for Android Developers" by Ian F. Darwin ISBN-13: 978-1449319510
6. "Android Application Development for Java Programmers" by James C. Sheusi ISBN-13: 978-0137057133
7. "Android Studio 3.0 Development Essentials" by Neil Smyth ISBN-13: 978-1942270679
8. "Android App Development for Dummies" by Michael Burton ISBN-13: 978-1118840492

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Modern College of Arts, Science and Commerce (Autonomous),
Shivajinagar, Pune – 5

T.Y. BCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU6201

Course Name: Database Technologies

Teaching Scheme: TH: 2 Hours/Week

Credit: 02

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Prerequisite Courses:

- Basic knowledge of Database Management Systems and SQL.
- Understanding of relational databases and normalization concepts.

Course Objectives:

- To understand advanced database technologies and modern database systems.
- To explore NoSQL databases and their applications.
- To study data storage models used in modern web applications.
- To learn database connectivity and basic database administration concepts.
- To understand distributed and cloud-based database systems.

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Explain advanced database technologies and database architectures	1
2	Understand NoSQL databases and different data models	2
3	Apply database operations using NoSQL databases	3
4	Analyze differences between relational and NoSQL databases	4
5	Explain distributed and cloud database concepts	5
6	Develop simple database applications using modern database technologies	6

Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Advanced Database Concepts	06
	1.1 Limitations of Traditional RDBMS 1.2 Need for New Database Technologies 1.3 Overview of Modern Database Systems 1.4 Database Scalability Concepts	

	1.5 CAP Theorem	
Unit 2	Introduction to NoSQL Databases	06
	2.1 Introduction to NoSQL 2.2 Characteristics of NoSQL Databases 2.3 Types of NoSQL Databases 2.4 Comparison between SQL and NoSQL 2.5 Applications of NoSQL Databases	
Unit 3	NoSQL Data Models	06
	3.1 Key-Value Databases 3.2 Document-Oriented Databases 3.3 Column-Family Databases 3.4 Graph Databases 3.5 Examples of NoSQL Databases	
Unit 4	Working with MongoDB	06
	4.1 Introduction to MongoDB 4.2 MongoDB Architecture 4.3 Creating and Managing Databases and Collections 4.4 CRUD Operations in MongoDB 4.5 Querying Documents in MongoDB	
Unit 5	Distributed and Cloud Databases	06
	5.1 Distributed Database Concepts 5.2 Data Replication and Sharding 5.3 Cloud Databases 5.4 Database as a Service (DBaaS) 5.5 Applications of Cloud Databases	

Reference Books:

1. **Seven Databases in Seven Weeks** – Eric Redmond, Jim R. Wilson, Pragmatic Bookshelf, ISBN: 9781934356920
2. **NoSQL Distilled** – Pramod J. Sadalage, Martin Fowler, Addison-Wesley, ISBN: 9780321826626
3. **MongoDB: The Definitive Guide** – Shannon Bradshaw, Kristina Chodorow, O'Reilly, ISBN: 9781491954461
4. **Designing Data-Intensive Applications** – Martin Kleppmann, O'Reilly Media, ISBN: 9781449373320

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T.Y. BCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU6202

Course Name: Lab Course on 24CsBcaU6201

Teaching Scheme: PR : 4 Hours/Week

Credit : 02

Examination Scheme: CIA: 20 Marks

End-Sem : 30 Marks

Prerequisite Courses:

- Basic knowledge of Database Management Systems (DBMS) and relational database concepts.
- Understanding of SQL queries and database operations such as SELECT, INSERT, UPDATE, and DELETE.

Course Objectives:

- To introduce modern database technologies and NoSQL databases.
- To understand the concepts and architecture of MongoDB.
- To perform CRUD operations and query processing in MongoDB.
- To understand data modeling techniques in NoSQL databases.
- To develop simple applications using MongoDB and Python connectivity.

Course Contents:

Sr.No	List of Assignments
1	Study and installation of MongoDB and MongoDB Compass.
2	Creation of database and collections in MongoDB.
3	Inserting documents into MongoDB collections.
4	Retrieving documents using basic MongoDB queries.
5	Updating documents in MongoDB collections.
6	Deleting documents from MongoDB collections.
7	Using comparison and logical operators in MongoDB queries.
8	Sorting and limiting query results in MongoDB.
9	Working with embedded documents and arrays in MongoDB.
10	Implementing aggregation operations in MongoDB.
11	Creating indexes in MongoDB collections.
12	Demonstration of data modeling in MongoDB.
13	Comparison study of SQL and NoSQL databases.
14	Connecting MongoDB with a Python application.
15	Developing a simple application using MongoDB to perform CRUD operations.

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TYBCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU6203

Course Name: Cloud Computing

Teaching Scheme: 4 Lectures/Week

Credits: 4

Examination Scheme: CIA : 40 Marks

End-Sem : 60 Marks

Prerequisites:

- Knowledge of Operating System Concepts
- Fundamentals of Computer Networks

Course Objectives:

- To introduce the fundamentals of cloud computing, Dockers and Containers.
- To give Insights into Cloud Service Models and Deployment Models.
- To provide knowledge on virtualization technologies.
- To know about Enterprise Cloud Architecture and Migration Strategies
- To impart the knowledge on Cloud-Native Application Development, AI/ML integration in the cloud

Course Outcomes:

After successful completion of this course students will able to:

CO No	Course Outcomes (COs)	Blooms Cognitive level
1	Define Cloud Computing, fundamentals of cloud computing, List desired features and benefits of Cloud Computing, Identify fundamentals of dockers and containers, serverless computing	1
2	Demonstrate cloud deployment models, cloud service models, XaaS- Anything as a Service. Explain cloud storage models and apply appropriate cloud database and big data storage services for managing data in cloud environments.	2
3	Discover the security and compliance challenges of cloud computing	3
4	Analyze enterprise cloud architectures including multi-cloud environments, cloud bursting models, migration strategies (6R framework), and compare virtualization with container-based architectures.	4
5	Examine the virtualization foundations to cater to the needs of elasticity, portability, and resilience of cloud service providers	5
6	Propose cloud-native architectures, containerization strategies, serverless	6

	models, and AI/ML cloud services to determine the most efficient, scalable, and cost-effective solution for modern enterprise workloads.	
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Course Contents:

Unit No.	Title	Number of Lectures
Unit 1	Introduction to Cloud Computing	13
	1.1 Introduction to Cloud Computing and need of Cloud Computing 1.2 Desired Features of a Cloud 1.3 Pros and Cons of Cloud Computing 1.4 Multitenant Technology 1.5 Cloud Service Models - IAAS, PAAS, SAAS & its Comparison 1.6 Cloud Deployment Models-Public, Private, Hybrid, Community 1.7 XAAS- Anything as a Service – Storage as a service, Network as a Service, Database as a Service 1.8 Service Level Agreement(SLA) in cloud computing, Billing, Pricing, and Support	
Unit 2	Virtualization in Cloud Computing	6
	2.1 Virtualization in Cloud Computing 2.2 Types of Virtualization 2.3 Pros and Cons of Virtualization in Cloud Computing 2.4 Load Balancing and Virtualization 2.5 Understanding Hypervisors	
Unit 3	Enterprise Cloud Architecture, Multi-Cloud, and Migration Strategies	7
	3.1 Cloud Computing Architecture 3.2 Multi Cloud Environment and Challenges in Multi-Cloud 3.3 Cloud Bursting 3.4 Cloud Migration, the 6 R's of Cloud Migration	
Unit 4	Cloud Storage and Data Management	8
	4.1 Types of Cloud Storage: Object Storage, Block Storage, File Storage 4.2 Database Services in Cloud 4.3 Managed Database Services in Cloud Platforms, Relational Databases (SQL) and NoSQL Database Services in Cloud, Scalability, Availability, and Automatic Backup in Cloud Databases, Examples of SQL and NOSQL Database Services from Major Cloud Providers 4.4 Big Data Storage in Cloud Environment	
Unit 5	Cloud-Native Application Development	13
	5.1 Traditional vs. Cloud Native Applications 5.2 Benefits of Adopting Cloud Native Approaches	

	5.3 Challenges of Cloud Native 5.4 Concepts of Cloud-Native and Microservice Architectures 5.5 Concept of Containers 5.6 Docker fundamentals 5.7 Container Orchestration, Kubernetes 5.8 Introduction to Serverless Computing, Benefits 5.9 Serverless Computing types 5.10 Serverless versus PaaS, Containers versus VMs	
Unit 6	AI, ML & Emerging Cloud Workloads	2
	6.1 AI/ML integration in the cloud and benefits 6.2 Cloud-Based AI/ML Services from major Cloud Providers 6.3 Emerging Cloud Workloads	
Unit 7	Cloud Security	10
	7.1 Privacy and Compliance Risks 7.2 Common Threats and Vulnerabilities 7.3 Cloud Access Control Issues 7.4 Cloud Service Provider Risks 7.5 Cloud Computing Security Challenges 7.6 Virtualization Security Management 7.7 Cloud Security Architecture 7.8 Identity Management and Access Control	
Unit 8	Experiential Learning	1
	Understanding cloud platforms and services of Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure (Microsoft Azure), Sales Force	

Reference Books:

1. Cloud Computing Bible by Barrie Sosinsky, John Wiley, ISBN-13 : 978-0470903568
2. Cloud Computing: Concepts, Technology & Architecture by Ricardo Puttini, Thomas Erl, and Zaigham Mahmood, PHI, ISBN-13 : 978-0133387520
3. Cloud Security a Comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz Russell Dean Vines, Wiley, ISBN: 978-0-470-93894-2.
4. Mastering Cloud Computing Foundations and Applications Programming by Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Morgan Kaufmann, ISBN-13 : 978-0124114548

E-Books:

1. <https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf>
2. <https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf>
3. <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-291r2.pdf>

MOOCs Courses link:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview?
2. Cloud Computing and Distributed System:

https://onlinecourses.nptel.ac.in/noc21_cs15/preview?

1. <http://kcl.digimat.in/nptel/courses/video/106105167/L01.html>

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TYBCA (Science)
(2024 Course under NEP)

Course Code: 24CsBcaU6501

Course Name: Lab Course on IoT

Teaching Scheme: 4 Hrs/Week

Credits: 2

Examination Scheme: CIA: 20 Marks

End-Sem: 30 Marks

Desirable Prerequisite:

Basic knowledge of Electronics and Computer Networks.

Course Objectives:

- To study fundamental concepts of IoT
- To understand roles of sensors, actuators in IoT
- To learn programming Arduino and Raspberry Pi
- To learn to implement IoT systems using open source IoT platforms.

Course Outcomes:

On completion of the course, student will be able to

- Understand the various concepts, terminologies and architecture of IoT systems.
- Use sensors and actuators for design of IoT.
- Use various techniques of data storage and analytics in IoT
- Design and develop IoT systems.

Sr.No.	Title of the assignment
1	Working with Arduino Introduction, Arduino Uno Board Anatomy, Arduino Software (IDE)
2	Programming Arduino Development Board using simulation software
3	Interfacing LEDs, sensors, motors with Arduino
4	Working with Raspberry Pi Raspberry Pi Hardware Specifications, About Raspbian , Linux Commands, Basic Hardware Needed to Run Your Raspberry Pi, Setting Up Your Raspberry Pi
5	Interfacing LEDs, analog and digital sensors with Raspberry Pi
6	Interfacing Servo Motors, DC motors with Raspberry Pi
7	Raspberry Pi Pulse Width Modulation(PWM)
8	Pi Camera Interface with Raspberry Pi
9	Sending Sensor Data to Cloud platform
10	IoT Device Controlling Using Cloud

11	Building Smart Home Cloud Service with Google
12	Interface Bluetooth with Arduino/Raspberry Pi to Turn LED ON/OFF when '1'/'0' is Received from Smart Phone Using Bluetooth
13	Controlling LED/Motor through Web Server
14	Mobile Application Connectivity for IoT
15	Uploading Data on Cloud using Wi-Fi ESP8266 Module
16	IBM Node-RED Tool
17	Using Google Firebase for IoT Device Configuration

Note: Assignments from 1 to 9 are Compulsory and 10 to 15 are Optional.

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TYBCA (Science)
(2024 Course under NEP)**

Course Code: 24CsBcaU6004

Course Name: On Job Training

Teaching Scheme: 8 Hrs/Week**Credits: 4****Examination Scheme: CIA: 40 Marks****End-Sem: 60 Marks**

OJT Evaluation Sheet

Department of _____

Class : _____

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Name and Signature of Internal Examiner

Name and Signature of External Examiner