

 Estd. 1962 "A++" Accredited by NAAC (2021) With CGPA 3.52	SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दूरध्वनी ०२३१-२६०९०९४ ०२३१-२६०९४८७	
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Ref.No.SU/BOS/Science/146

Date: 26/05/2026

The Principal,
 All Concerned Affiliated Colleges/Institutions
 Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper B.Sc. Part-III (Sem.V & VI) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-III (Sem. V & VI) as per NEP-2020 (2.0)			
1.	Animation (Entire)	6.	Food Science and Technology (Entire)
2.	Food Science (Entire)	7.	Food Technology & Management (Entire)
3.	Biotechnology (Entire)	8.	Environmental Science (Entire)
4.	Computer Science (Entire)	9.	Sugar Technology (Entire)
5.	Information Technology (Entire)		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2026-2027 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in>Syllabus>Syllabus as per NEP2020.

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2026 & March/April 2027. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,



Dy Registrar

Encl: as above

for information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR



NAAC A++ Grade with CGPA 3.52

As per
National Education Policy (NEP-2020)

Syllabus for
Bachelor of Science
Computer Science (Entire)
(Under Faculty of Science and Technology)

PART-III SEMESTER V & VI

(Syllabus to be implemented from Academic Year 2026-27)

B.Sc. (Computer Science) Part III Semester V & VI
(NEP-2020)

Syllabus to be implemented from Academic Year 2026–27

Semester V

B.Sc. (Computer Science) Part-IIISEMESTER-V (Duration-Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment(UA)			Internal Assessment(IA)		
		Lectur es Per wee k	Practical Per week	Credit	Maxim um Marks	Minim um Marks	Exam minute	Maximum Marks	Minimu m Marks	Exam Hours
1	Major IX: Core Java	2	-	2	40	16	90	10	04	20
2	Major X: C# .Programming	2	-	2	40	16	90	10	04	20
3	Major Practical V (a) : Core Java Lab	-	4	2	40	16	90	10	04	20
	Major Practical V (b) : C# .Programming Lab	-	4	2	40	16	90	10	04	20
4	Major Elective I ✓ Python Programming ✓ Basics of Linux Operating System	2	-	2	40	16	90	10	04	20
5	Major Practical II ✓ Python Programming Lab ✓ Basics of Linux Operating System Lab	-	4	2	40	16	90	10	04	20
6	Open Elective V: To be selected from OE Basket	2	-	2	40	16	90	10	04	20
7	VSC II (Major Specific) : React JS	-	4	2	40	16	90	10	04	20
8	AEC III: Corporate Culture And Communication	2	-	2	40	16	90	10	04	20
9	OJT: On Job Training	-	-	4	80	32	180	20	08	40
	Total (A)			22	440			110		

B.Sc. (Computer Science) Part-III SEMESTER-VI (Duration-SixMonth)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment(UA)			Internal Assessment(IA)		
		Lectur es Per week	Practical Per week	Credit	Maximum Marks	Minimum Marks	Exam minute	Maximum Marks	Minimum Marks	Exam Hours
1	Major XI: Advanced Java	2	-	2	40	16	90	10	04	20
2	Major XII: ASP.NET	2	-	2	40	16	90	10	04	20
3	Major Practical VI (a): Advanced Java Lab	-	4	2	40	16	90	10	04	20
4	Major Practical VI (b): ASP.NET Lab	-	4	2	40	16	90	10	04	20
5	Major Elective II ✓ Machine Learning with Python ✓ Advanced Linux Operating System	2	-	2	40	16	90	10	04	20
6	Major Practical II ✓ Machine Learning With Python Lab ✓ Advanced Linux Operating System Lab	-	4	2	40	16	90	10	04	20
7	VSC III (Major Specific): MERN Stack	-	4	2	40	16	90	10	04	20
8	SEC III - Artificial Intelligence	2	-	2	40	16	90	10	04	20
9	AEC IV: Professional Ethics & Corporate Skills	2	-	2	40	16	90	10	04	20
10	IKS: IKS for Computer Science	2	-	2	40	16	90	10	04	20
11	FP: Field Project	-	-	2	40	16	90	10	04	20
	Total (B)			22	440			110		

Exit option after Level6: Students can exit with Bachelor of Science in Computer Science (Entire)

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major IX - Core Java

Course Outcomes:

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

1. Understand the basic features of Java and apply Java fundamentals, including data types, variables, operators, type casting, control structures, and arrays, to develop simple Java programs.
2. Design and implement object-oriented programs using classes and objects, and demonstrate the use of collections.
3. Demonstrate understanding of object-oriented concepts such as inheritance, polymorphism, abstraction, interfaces, and packages.
4. Implement exception handling mechanisms and develop multithreaded applications.

UNIT-I Java Fundamentals and Introduction to Object-oriented Programming (15 Hours)

Features of Java, Java Virtual Machine (JVM), Structure of a Java program, Compilation and execution of a Java program, Java keywords, Data types, Java variables – declaration and assignment of values to the variable (using assignment statement and Scanner class object), Scope of variables, Operators in Java, Type casting – implicit and explicit casting, Control structures in Java – Branching/Decision making statements – if, if-else, if-else-if and switch statement, Iterative/looping statements – for loop, do-while loop, while loop, Jumping statements – break and continue statements, Introduction to classes, objects and methods, Defining a class, field declaration, method declaration, Initialising and accessing class members, Method overloading, Constructor – types of constructors, this keyword, static members, wrapper class, Array, types of arrays, array of objects, Collection framework- ArrayList, HashMap, and ConcurrentHashMap

UNIT-II Object-Oriented Programming, Exception Handling and Multithreading (15 Hours)

Inheritance - definition, syntax, types of inheritance, method overriding, super keyword, dynamic method dispatch, abstract class and method, final keyword, interface - defining and implementing an interface, implementing multiple inheritance using an interface, packages - Java API package, defining and accessing a user-defined package, use of access specifiers in a package, concept of exception and exception handling, exception handling using try and catch blocks, Multiple catch block, finally block, throws keyword, User defined exception, Concept of multithreading in java, Creating thread by extending Thread class and by implementing Runnable interface, Life cycle of thread, Thread synchronization

Reference Books:

1. Herbert Schildt, Java: The Complete Reference, McGraw-Hill, 13th Edition (2023)
2. E. Balagurusamy, Programming with Java: A Primer, McGraw-Hill, 6th Edition (2019)
3. Kathy Sierra, Bert Bates, and Trisha Gee, Head First Java, O'Reilly Media, 3rd Edition (2022)
4. Cay S. Horstmann, Core Java, Volume I: Fundamentals, Pearson Education / Prentice Hall, 12th Edition (2022)

B.Sc. Computer Science Entire

Multiple Entry and Multiple Exit Option (NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major X - C# Programming

Course Outcomes:

After completion of this course students will be able to:

1. Understand the framework and architecture of .NET
2. Learn Common Type System of .NET.
3. Learn Object Oriented Concepts of C#.Net
4. Learn Graphical User Interface with Windows form controls their properties, methods and events.

UNIT-I Introduction to .NET

(15 Hours)

An Overview of C#, History and Features of C#, .NET Framework Architecture, IDE – (Integrated Development Environment), Components of .NET: CLR, CLS, Microsoft Intermediate Language ("MSIL" or "IL"), Common Type System (CTS), Data Types, Value and Reference Types, C# Flow Control: Branching, Looping and jumping, Type casting, Boxing and Unboxing, JIT compiler and it's types, .DLL and .EXE

UNIT-II Object Oriented Concepts and Windows Form Applications Using C#

(15 Hours)

Object Oriented Concepts: Classes and Objects, Command Line Arguments, Polymorphism, Inheritance and it's types- Single, Multiple, Multilevel, Hierarchical, Parameter Passing Mechanism – 'val' and 'ref', Abstract Classes, Sealed Classes, Partial Classes, Exception Handling

Introduction to Windows Form Applications Using C#: Developing GUI Application Using WINFORMS - Basic Controls, Form Controls: Label, Button, Textbox, Checkbox, ComboBox, RadioButton, Timer, calendar, List Box, Image, DateTimePicker, MonthCalender, PictureBox, GroupBox, Panel, Dialog Control – ColorDialog, OpenFileDialog, SaveFileDialog, FontDialog and overview of remaining all common controls its properties and events.

Reference Books:

1. Programming in C#, E Balagurusamy, McGraw-Hill Education 4th Edition
2. C# 4.0 The Complete Reference SchildtMcGraw Hill
3. Microsoft Visual C# Step by Step, John Sharp, Pearson Education / Microsoft Press, 10th Edition

Multiple Entry and Multiple Exit Option(NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major IX Practical V (a)

Core Java Lab

Course Outcomes:

After completion of this course students will be able to:

1. Understand Fundamental Programming Concepts of Java.
2. Apply Object-Oriented Programming Concepts.
3. Handle Exceptions.
4. Apply multithreading concepts.

***Perform the following programming using Java programming**

1. Write a program to check given number is Odd OR Even. If the number is odd, check whether it is a multiple of 5. If the number is even, check whether the number is a multiple of 4.
2. Write a program to display the sum of the digits of a given number.
3. Write a program to validate character input, numerical input, mobile number input and email input.
4. Write a Java program to define a class, objects, a field and a method.
5. Write a Java program to demonstrate method overloading.
6. Write a Java program to demonstrate constructors and constructor overloading.
7. Write a Java program to define an array of Strings and display the array elements.
8. Write a Java program to find the count of duplicate numbers in an array.
9. Write a Java program to define a jagged array and display the jagged array elements using a for-each loop.
10. Write a Java program to demonstrate an array of objects.
11. Write a Java program to create an ArrayList of Integers and display the elements of the ArrayList.
12. Write a Java program to demonstrate Inheritance (Use the super keyword).
13. Write a Java program to demonstrate a user-defined package and the use of access specifiers.
14. Write a Java program to demonstrate an abstract class.
15. Write a Java program to demonstrate multiple inheritance using an interface.
16. Write a Java program to demonstrate user defined exception.
17. Write a Java program to demonstrate multithreading (e.g., create and run multiple threads using different thread life cycle methods)

Multiple Entry and Multiple Exit Option(NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major IX Practical V (b)

C# Programming Lab

Course Outcomes:

After completion of this course students will be able to:

1. Learn C#, including syntax, variables, data types, and operators.
2. Understand and apply object-oriented programming (OOP) concepts
3. Create and use methods to organize your code and make it easier to understand.
4. Handle errors in your code and write code to manage them properly.

Following is a list of assignments for practical of C# Programming;

1. Write a C# program to check if a given number is Divisible by 2.
2. Write a C# Program to check Whether a Given Number is Perfect Number using CLA.
3. Write a console application for swapping of 2 numbers using Pass by value, Pass by Reference.
4. Write a C# program to demonstrate boxing and unboxing.
5. Write a C# program to demonstrate Multilevel Inheritance.
6. Write a C# program to demonstrate Interface.
7. Write a C# program to demonstrate Sealed Class.
8. Write a C# program to demonstrate Abstract methods and Abstract Class.
9. Write a C# program to demonstrate Partial Class.
10. Write a C# program to demonstrate NullReferenceException handling.
11. Design and develop the C# windows applications using different basic controls.
12. Design and develop the C# windows applications for demonstration of DLL and EXE applications.
13. Design and develop the C# windows application to demonstration of Image and PictureBox control.
14. Design and develop the C# windows application to add & delete single and multiple ListBox and ComboBox items.
15. Design and develop the C# windows application to demonstration of MonthCalender control.
16. Design and develop the C# windows application to demonstration of DateTimePicker.
17. Design and develop the C# application using following different Dialog Control.

Subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes

B.Sc. Part – III Computer Science (Entire)
Multiple Entry and Multiple Exit Option (NEP -2020)
PART III SEM V (Level - 5.5)

Title of Course: Major Elective I (Subject 1) – Python Programming

Course Outcomes:

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

1. Acquire programming skills in Python.
2. Understand and Develop advance Concepts in Python Programming.
3. Develop problem solving skills and their implementation through Python.
4. Use of functions and modules in Python programs.

UNIT I Introduction to Python

(15 Hours)

History of Python, Python Features, Applications of Python, Installing Python and Setting up the Environment, Working with Python, Basic Syntax, Keywords, Data Types, Operators, Input - output functions, Conditional Statements & Looping: If, If-else, Nested if-else, For, While, Nested loops. Control Statements: Break, Continue, And Pass. String Manipulation: Accessing Strings, Basic Operations, String slices Function and Methods.

UNIT II Data Structures, Functions and Modules In Python

(15 Hours)

Data Structures:

Lists-Create a List, Get and Set Items, Add and Remove Items, List Slices, Different List Function and Methods. Creation and Accessing Values using tuple, Updating Tuples, Deleting Tuple Elements, Basic Tuples Operations, Indexing, Slicing. Accessing Values in Dictionary, Updating Dictionary, Delete Dictionary Elements, Properties of Dictionary Keys, Built-In Dictionary, Working with dictionaries, Properties, Functions and Methods. Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Concept of Sets, Creating, Initializing and Accessing the Elements, Sets Operation. Importing module, (Datetime, Calendar, Math Module), Random module, Packages, Composition, File operations, Text Files, Reading And Writing Files Exception, Exception Handling, Except clause, Try, finally clause, User Defined Exceptions.

Reference Books –

1. Practical Programming: An introduction to Computer Science Using Python, second edition, Paul Gries, Jennifer Campbell, Jason Montoyo, The Pragmatic Bookshelf.
2. R. NageswaraRao, “Core Python Programming”, Dreamtech
3. Programming with python, A users Book, Michael Dawson, Cengage Learning
4. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication
4. Introduction to Python for Computational Science and Engineering (A beginner's guide), Hans Fangohr
5. O Level Programming and Problem Solving Through Python Language: Made Simple :Paper back by Prof. Satish Jain (Author), Shashi Singh

B.Sc. Part – III Computer Science (Entire)
Multiple Entry and Multiple Exit Option (NEP -2020)
PART III SEM V (Level - 5.5)

Title of Course: Major Elective I (Subject 2) – Basics of Linux Operating System

Course Outcomes:

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

1. Understanding Concept of Operating System.
2. Understanding GPU and File handling command.
3. Understanding Shell scripting.
4. Understanding Conditional and looping statement.

UNIT – I Introduction to Operating System

(15 Hours)

Definition of Operating System, Need and Functions of Operating System, Operating Systems: Basics of Unix. Introduction to Linux, Comparison of Linux with Windows Operating System. Architecture of Linux, Login, Logout, Shell, Kernel, GPU Commands (cal, date, who, tty, uname, password, lock, echo, tput, bc, clear, script, wc, test, expr, etc.), Directory Management (mkdir, cd, rmdir). File Handling using Linux Commands – ls, cat, cp, mv, rm, Types of Files, chmod command, Creating Files using VI Editor, Handling Command Mode, Insert Mode and Ex Mod

UNIT – II Shell Programming

(15 Hours)

Concept of Shell scripting, Operators In Bash Shell (Arithmetic, Relational, Logical, Assignment, Reassignment, Bit Wise), Conditional statements-if,if else,case. looping-for,while, until, Continue and break statement. read, echo statement, Writing and executing shell script.

Reference Books –

1. Operating System Concepts–Silberschatz,Galvinand Gagne
2. Operating System By Godbole
3. Linux Bible 9th Edition by Christoper Negus ISBN :978-1-118- 99987-54.Ball, Using Linux, PHI, 1998. ISBN-10: 0789716232
4. UNIX:ConceptsandApplicationsDas(4thEd),TMH,2006ISBN19780070635463

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major Elective Practical

Python Programming Lab

Course Outcomes:

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

1. Understand and trace the execution of programs written in python language.
2. Learn how to write loops and decision statements in Python.
3. Learn how to use lists, tuples and dictionaries in Python programs.
4. Learn how to use of functions, modules and exception handling in Python programs.

Following is a sample list of assignments for practical;

Instructors are advised to provide more lab assignments to students to meet the course specified outcomes.

- 1) Write a Python program for simple interest
- 2) Write a Python program to check if a string is palindrome or not
- 3) Write a Python program to find out ways to remove i'th character from string in python
- 4) Write a Python program to interchange first and last elements in a list
- 5) Write a Python program to find out different ways to clear a list in Python
- 6) Write a Python program to reversing a List
- 7) Write a Python Program to display maximum number and minimum number from given list
- 8) Write a Python Program to display the Calendar of a given month.
- 9) Write a Python Program to demonstrate use of dictionaries by Key or Value
- 10) Write a Python Program to remove a key from dictionary
- 11) Write a simple Python function to check whether x is even or odd
- 12) Write a function that takes a character and returns True if it is a vowel, False otherwise
- 13) Define a function histogram () that takes a list of integers and prints a histogram to the screen. For example, histogram
- 14) Write a simple module (e.g. calc.py) for addition and subtraction
- 15) Write a program for importing sqrt() and factorial from the module math
- 16) Write a Python program to handle simple runtime error.
- 17) Write program to handle multiple errors with one except statement.
- 18) Write a python program to create user-defined exception.
- 19) Program to demonstrate File input.
- 20) Program to demonstrate file output.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)

PART III SEM V (Level- 5.5)

Title of course: Major Elective Practical

Basics of Linux Operating System Lab

Course Outcomes:

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

1. Understand and trace the execution of programs written in Linux Operating System.
2. Learn how to write Linux commands with attributes.
3. Learn how to write Shell scripting.
4. Learn how to write conditional and Looping Statement in Linux .

List of Practicals

1. Starting and Stopping Linux: Booting a Linux System, Shutting Down a Linux System.
2. Demonstration of Linux commands with attributes: pwd, cd, ls, echo, clear, kill, ps, man, cal, date, who, who am I, wc, mkdir, rmdir, rm, sort.
3. Creation of files and changing their permission using chmod command.
4. Write a shell script which checks whether a given number is prime or not.
5. Write a shell script to modify the “cal” command to display calendars of the specified range of months.
6. Write a shell script which displays date in the mm/dd/yy format.
7. Write a shell script which checks whether a given number is positive or not.
8. Write a shell script to display the multiplication table of a given range.
9. Write a shell script to find the sum of digits of a given number.
10. Write a shell script to find the LCD (Least Common Divisor) of two numbers.
11. Write a shell script to find the factorial of a given number.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Title of course: VSC II (Major Specific): React JS

Course Outcomes:

After completion of this course students will be able to:

1. Develop React applications using components, hooks, and routing.
2. Build single-page interfaces with forms, events, and UI features.
3. Perform CRUD and query operations using MongoDB.
4. Integrate React with MongoDB to build full-stack applications.

Following is a list of assignments for practical of React JS;

Subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes.

1. Install Node.js and create a React application using Vite. Study the project folder structure and modify the entry point (main.jsx) to display a custom message.
2. Create a React application demonstrating JSX and Functional Components by designing reusable components such as Header, Footer, and ProfileCard.
3. Develop a React component that accepts and displays student information using Props.
4. Design a Counter Application using the useState hook with Increment, Decrement, and Reset functionalities.
5. Create a React application that demonstrates event handling by capturing user input through form elements.
6. Develop a controlled form with basic validation for required fields, email format, and password length.
7. Build a React application that fetches data from a REST API using the useEffect hook and displays the results.
8. Create an application demonstrating the use of useRef for DOM manipulation (e.g., focusing an input field).
9. Implement navigation in a React SPA using React Router v6+, including Routes, Links, and URL Parameters.
10. Develop a React application demonstrating conditional rendering and rendering dynamic lists using .map() with proper keys.
11. Install MongoDB and create a database with collections using MongoDB Compass.
12. Perform Create operations using insertOne() and insertMany().
13. Execute queries using find() and findOne() with projections.
14. Modify documents using update operators such as \$set, \$unset, and \$inc.
15. Delete documents using deleteOne() and deleteMany().
16. Perform conditional queries using operators like \$gt, \$lt, \$in, \$and, and \$or.
17. Implement sorting and pagination using sort(), limit(), and skip().
18. Create indexes and analyze query performance using the Explain Plan.
19. Perform aggregation operations using pipeline stages such as \$match, \$group, \$sort, and \$project.
20. Demonstrate embedding and referencing techniques and perform joins using \$lookup.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option(NEP-2020)
PART III SEM V (Level- 5.5)
Title of course: AEC III: Corporate Culture & Communication

Course Objectives

After completion of this course students will be able to:

1. To develop effective professional communication skills
2. To understand organizational and cross-cultural workplace behavior
3. To enhance ethical, digital, and AI-era communication competence.
4. To prepare students for corporate and global work environments.
5. Communicate effectively in professional environments.
6. Draft business documents and reports.

UNIT I: (15 Hours)

Introduction to Business Communication: Meaning and definition of business communication Objectives and importance in organizations .Types: internal & external communication Role of communication in AI-driven businesses. Communication Process and Models: Elements of communication process, Models of Communication Cycle, Characteristics of Professional communication, Barriers to communication, Overcoming communication barriers. Verbal and Non-Verbal Communication: Verbal communication: oral and written Non-verbal communication: body language, kinesics, proxemics, Paralanguage and visual communication -Impact of non-verbal cues in professional settings. Written Business Communication: Principles of effective business writing .Business letters: inquiry, complaint, adjustment, Emails, memos, notices, Report writing: short reports and summaries, AI tools in business writing (email drafting, grammar tools) Oral Communication & Presentation Skills: Meetings: types and conduct, Interviews: preparation and participation, Public speaking and presentation skills, Use of visual aids and AI presentation tools

UNIT II: (15 Hours)

Concept of Culture in Business: Meaning and elements of culture Organizational culture: types and significance, Corporate culture in technology-based organizations, Cultural diversity in the workplace Cross Cultural Communication: High-context and low-context cultures, Hofstede's cultural dimensions Cross-cultural challenges in global business, Communication in multicultural teams ,AI and globalization of workplace communication. Professional Ethics and Corporate Etiquette: Meaning and importance of business ethics, Ethical issues in communication, Corporate etiquette: workplace behavior, dress code ,Email, meeting, and virtual etiquette, Ethics in AI communication and data usage. Digital Communication and AI Workplace Culture: Digital communication tools and platforms ,Social media communication for business, Remote work culture and virtual collaboration ,Impact of AI on organizational communication, Future trends in business communication.

Reference Books-

1. Bovee, C. L. & Thill, J. V. Business Communication Today
2. Lesikar, R. V. Business Communication: Theory and Application
3. Hofstede, G. Cultures and Organizations
4. Guffey, M. E. Business Communication: Process and Product

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Title of course: On Job Training

Course Outcomes:

After completion of this course students will be able to:

1. Apply theoretical knowledge gained during the academic program to real-world industrial or organizational tasks.
2. Demonstrate professional work ethics, discipline, time management, and responsibility in a workplace environment.
3. Develop technical and practical skills relevant to the specific industry or domain of training.
4. Exhibit effective communication, teamwork, and interpersonal skills while working with professionals.
5. Analyze workplace problems and propose practical solutions using appropriate tools and methodologies.
6. Prepare a comprehensive training report and present learning outcomes, reflecting on professional growth and career readiness.

Detailed Guidelines will be provided by Shivaji University, Kolhapur

B.Sc. Computer Science (Entire)
Multiple Entry and Multiple Exit Option (NEP-2020)

PART III SEM VI (Level- 5.5)

Title of course: Major XI: Advanced Java

Course Outcomes:

After completion of this course students will be able to:

1. Analyze and implement database connectivity in Java applications using the JDBC architecture and various driver types. Develop and deploy dynamic web resources using the Servlet API, managing the request-response lifecycle and directory structures.
2. Create interactive server-side pages using JSP elements, implicit objects, and action tags to separate presentation from business logic.
3. Architect scalable web applications using the Model-View-Controller (MVC) design pattern, integrating Servlets, JSP, and JavaBeans.
4. Utilize modern frameworks (Hibernate and Spring Boot) to simplify data persistence (ORM) and build RESTful web services.

UNIT-I JDBC and Servlet

(15 Hours)

Introduction to JDBC architecture, Types of JDBC drivers, Steps to connect Java application with database, Connectivity with MySQL, Statement, Prepared Statement, CallableStatement, ResultSet, simple JDBC program using console, Introduction to web terminologies, Life cycle of Servlet, Servlet API and directory structure, Handling client request & response, Session tracking (Cookies, URL rewriting, Hidden Form Field, HttpSession), servlet-JDBC connection

UNIT-II JSP and MVC Architecture

(15 Hours)

Introduction to JSP, Life cycle of JSP, JSP elements (directives, scripting elements, action tags), Implicit objects, Form handling, Session management in JSP, JSP-JDBC connection. Introduction to MVC design pattern, Components of MVC (Model, View, Controller), Flow of control in MVC, Implementing MVC using Servlet as Controller, JSP as View, JavaBeans / POJO as Model, Advantages of MVC in web application, Developing a simple MVC-based CRUD project, Hibernate: Introduction to ORM, ORM vs JDBC, Hibernate Architecture, Hibernate CRUD using JPA, Spring: Spring IoC, Spring Dependency Injection, Spring Boot, REST API architecture, Spring Data JPA

Reference Books:

1. Bryan Basham, Kathy Sierra, and Bert Bates, Head First Servlets and JSP O'Reilly Media, Inc., 2nd Edition, 2008
2. Christian Bauer, Gavin King, Gary Gregory, Java Persistence with Hibernate, Dreamtech Press, Revised 2nd, 2016

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: Major XII: ASP.NET

Course Outcomes:

After completion of this course students will be able to:

1. Understand working of Asp.Net Web Application.
2. Demonstrate Asp.Net different Server Controls.
3. Understand importance and working of State Management.
4. Study database operations using ADO.NET.

UNIT-I Introduction to ASP.NET

(15 Hours)

Introduction to Scripting Languages, ASP.NET Introduction, Features of ASP.NET, Web browser and web server, HTTP request response structure, HTML form elements, GET/POST method, Client side and Server side programming, Web form life cycle, Page events, Server Controls: Label, Textbox, Button, LinkButton, RadioButton, CheckBox, Image, ImageButton, ImageMap, Listcontrols – DropDownList, ListBox, CheckBoxLayout, RadioButtonList, Panel, FileUpload, Calendar, Literal Control, Validation Controls, Navigation controls, Master Page.

UNIT-II State Management, Database Connectivity and Reporting

(15 Hours)

State Management: Cross page postback property of button, Response.Redirect, Server.Transfer, Response.Write, State Management - Session, Application, Global.asax, Caching.

Database Connectivity: SqlServer Database, Data Controls -GridView, DataList, FormView, DetailsView, ListView and Repeater, Introduction to ADO.Net, ADO.NET Architecture- Connection, command, data reader, data adapter, data set, Understanding connected layer of ADO.NET and disconnected layer of ADO.NET. , **Reports-** Crystal Report, Data Report .

Reference Books:

1. ASP.NET Black Book- By Steven Holzner
2. Professional ASP.NET 2 –Wrox Series- Wallace B. McClure
3. Asp.Net using C#- RajendraSalokhe
4. Asp.Net: The Complete Reference Schildt McGraw Hill

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option(NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: Major XI Practical VI (a)
Advanced Java Lab

Course Outcome

After completion of this course students will be able to:

1. Create web applications using Servlets and JSP and Handle form data in JSP.
2. Build structured and maintainable CRUD applications using MVC pattern.
3. Use Hibernate framework for database operations and Develop CRUD applications using ORM techniques.
4. Create Spring Boot applications and Develop REST APIs using GET, POST, PUT, DELETE methods

Following is a sample list of assignments for practical, subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes.

Advanced Java

1. Write a Java program to implement simple CRUD using a console menu-driven program.
2. Write a Java program to demonstrate Cookies.
3. Write a Java program to demonstrate HttpSession.
4. Write a Java program on Servlet-JDBC CRUD application (Student Management: expected one or two forms only).
5. Write a Java program to demonstrate a JSP form handling example.
6. Write a JSP program for session management.
7. Write a Java program to demonstrate a JSP-JDBC connectivity example.
8. Write a login form validation program using JSP.
9. Write a Java program to demonstrate a JSP CRUD (Student/Employee Management) application (expected one or two forms only)
10. Write a Java program to demonstrate an MVC Login Application.
11. Write a Java program to demonstrate an MVC CRUD Application (Student Management).
12. Write a Java program to demonstrate Hibernate CRUD using JPA annotations.
13. Write a Java program to demonstrate a Spring Boot Hello World application.
14. Write a Java program to demonstrate a Spring Boot REST API example.
15. Write a Java program to demonstrate REST API with GET, POST, PUT, and DELETE methods.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option(NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: Major XI Practical VI (b)
ASP.NET Lab

Course Outcome

After completion of this course students will be able to:

1. Develop Data-Driven Applications
2. Implement Security & State Management
3. To handles SQL Server Database using ADO.NET

Following is a sample list of assignments for practical, subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes.

1. Write an Asp.Net Program to print a Message on web form.
2. Design and Develop an Asp.Net Program to Create Web Application using two or more web form.
3. Design and Develop an Asp.Net Program to set a link for new Page.
4. Design and Develop an Asp.Net Program to demonstrate different common Control.
5. Design and Develop an Asp.Net application to check given year is leap year or not.
6. Design and Develop an Asp.Net application to calculate factorial of given numbers.
7. Design and Develop an Asp.Net application to add the value of Text Box in to DropDownList and ListBoxControls.
8. Design and Develop an Asp.Net to Delete Items from Dropdown list and List box.
9. Design and Develop an Asp.Net application to set Image on Image Control according to selection of image name from dropdown list.
10. Design and Develop an Asp.Net application on Response.Redirect & Server.Transfer
11. Design and Develop an Asp.Net application on cross page posting.
12. Design and Develop an Asp.Net application on client-side state management
13. Design and Develop an Asp.Net application on server-side state management
14. Design and Develop an Asp.Net Program to perform Insert and update operation in Database using Connected architecture.
15. Design and Develop an Asp.Net program to perform Search and Delete operation in Database using disconnected architecture.
16. Design and Develop an Asp.Net Program to demonstrate use of Master Page for university website.

B.Sc. Part – III Computer Science (Entire)

Multiple Entry and Multiple Exit Option (NEP -2020)

PART III SEM VI (Level - 5.5)

Title of Course: Major Elective II (Subject 1) – Machine Learning with Python

Course Outcomes:

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

1. Apply the concepts of Machine Learning techniques to solve the problems across various domains.
2. To understand concepts and usage of NumPy packages for numerical data calculations in Python.
3. To understand concepts and applications of various data visualization tools of Python on real world data.
4. To understand and implement the Machine Learning Concepts in Python.

UNIT – I: Introduction To Machine Learning

(15 Hours)

Introduction: Definition, History and Application of Machine Learning, Types of Machine Learning (Supervised, Unsupervised, Semi-Supervised, and Reinforcement Learning) Types of Datasets (Labeled and Unlabeled Datasets) , Testing and validating, learning problems, Designing a Learning system, Perspectives and Issues.

Supervised Learning and Unsupervised Learning-Regression (Linear and Non-Linear Regression), Logistic Regression, Classification Algorithms (Naive Bayes, K-Nearest Neighbors, Decision Trees) Clustering Algorithms (K-Means, Hierarchical Clustering, DBSCAN, Clustering Validation Measures) Performance Evaluation Parameters (Confusion Matrix, Accuracy, Precision, Recall, F1 Score, AUC)

Introduction to NumPy: Creation on Array, Array generation from Uniform distribution, Random array generation, reshaping, maximum and minimum, reshaping, Arithmetic operations, Mathematical functions, Bracket Indexing and Selection, Broadcasting, Indexing a 2D array (matrices).

UNIT – II Neural Networks and Visualization

(15 Hours)

Neural Networks: Introduction to Neural Networks, Ethical Considerations in Machine Learning, Case Study and Real-World Application.

Introduction to Visualization: Installing and setting up visualization libraries, Canvas and Axes, Subplots, Common plots – scatter, histogram, boxplot, Logarithmic scale, Placement of ticks and custom tick labels, Pandas Viz, Style Sheets, Plot type, Area, Bar plots, Histograms, Line Plots, Scatter Plots, Boxplots, Hexagonal Bin Plot, Kernel Density Estimation plot (KDE), Distribution Plots, Categorical Data Plots, Combining Categorical Plots, Matrix Plots, Regression Plots, Grids; Python Visualizations toolkits/libraries.

Reference Books –

1. Charles Dierbach, Introduction to Python using Computer Science, Wiley Publications, Second Edition, 2015
2. Mark Lutz, Learning Python, O'Reilly publications, Fifth Edition, 2015
3. Machine Learning - An Algorithmic Perspective, Stephen Marsland, 2nd Edition, 2015.

4. Storytelling with Data: A Data Visualization Guide for Business Professionals Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.
5. Data Visualization: A Practical Introduction; Kieran Healy, Princeton University Press, 2018

B.Sc. Part – III Computer Science (Entire)

Multiple Entry and Multiple Exit Option (NEP -2020)

PART III SEM VI (Level - 5.5)

Title of Course: Major Elective II (Subject 2) –Advanced Linux Operating System

Course Outcomes:

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

1. Understand the working and use of NANO editor.
2. Learn Regular expressions using metacharacters.
3. Learn filters with the help of regular expression.
4. Learn advanced BASH shell Programming

UNIT – 1 Memory Management, NANO Editor and Regular Expressions (15 Hours)

Memory Management: Swapping, Demand Paging, Paging, and Segmentation. NANO Editor: Installing the Nano Text Editor in Linux, Nano Command Keys, Create a New File using Nano, Open an Existing File Using Nano, Edit Files Using Nano Text Editor in Linux, Cut and Paste Lines of Text Using Nano, Valid Shortcuts in Nano Text Editor, Search Text Using Nano, Spell Check Using Nano, Save Your Work Using Nano, Save with Backups. Regular Expressions: Metacharacters, Controlling Repeated Characters through *, +, and?, Using and Modifying the '.' Metacharacter, Controlling Where a Pattern Matches, Matching from a List of Options, Matching Characters That Must Not Appear, Matching Metacharacters Literally, Controlling Repetition, Selecting between Sequences

UNIT – 2 Filters and Advanced BASH Shell Programming (15 Hours)

Filters: cat, tac, head, tail filters and options, sed and sed options, grep and grep options, Line Addressing, Multiple Instruction (-E and -F), Context Addressing, Writing Selected Lines to a File. Advanced BASH Shell Programming: Seq Command for sequence, Shell and subshell, Exporting Shell Variables, Arrays, String Manipulation, Shell Functions.

Reference Books –

1. LINUX with Operating System Concepts by Richard Fox, CRC Press
2. Linux Commands- Instant Reference by Bryan PF affenberge
3. The Design of the Unix Operating System- Bach
4. Unix Shell Programming- Yashwant Kanetkar
5. Unix Concepts and Application – Sumitabhadas
6. Linux : The Complete Reference- Richard Peterson

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Title of course: Major Elective Practical II
Machine Learning With Python Lab

Course Outcomes:

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

1. Apply Python programming concepts to implement basic and advanced machine learning algorithms.
2. Perform visualization using Python libraries.
3. Develop and evaluate machine learning using libraries like NumPy,
4. Apply unsupervised learning algorithms like K-Means clustering for data grouping and analysis

Practical Based on Machine Learning using Python

Following is a sample list of assignments for practical; instructors are advised to provide more lab assignments to students to meet the course specified outcomes.

1. Use any numerical dataset with one dependent variable and one independent variable and implement a linear regression model. Visualize the data points and plot the regression line.
2. Choose any binary classification dataset (use only two classes). Implement logistic regression. Plot the decision boundary between the two classes.
3. Choose any classification dataset. Implement a decision tree classifier and visualize the decision tree
4. Implement a random forest classifier using a numerical dataset.
5. Implement a support vector machine for linearly separable classes and visualize decision boundary along with the margins
6. Implement K-Means clustering on a point dataset and visualize and evaluate the clusters.
7. Implement hierarchical clustering on a dataset and plot the dendrogram.
8. Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.
9. Creating Basic Visualizations
 1. Creating various chart types (bar, column, line, pie, area, etc.,)
 2. Formatting and customizing visualizations Publishing and Sharing Reports
 4. Sharing reports and dashboards with team members.
 5. Setting up data refresh schedules and managing permissions.
10. **Array Creation and Attributes:**
 - 1) Create a 4x2 integer array and print its shape, dimension (ndim), and data type (dtype).
 - 2) Generate a 5x5 array of random integers between 10 and 100.
11. **Indexing and Slicing:**
 - 1) Create a NumPy array with values from 1 to 12 in a 4x3 shape.
 - 2) Extract and print the second row.
 - 3) Extract and print a 2x2 submatrix from the top-left corner.
12. **Mathematical Operations:**
 - 1) Create a 10x10 array with random values and find its minimum, maximum, mean, and standard deviation.
 - 2) Perform a dot product (matrix multiplication) of a 5x3 matrix by a 3x2 matrix.
13. **Array Manipulation:**
 - i. Reverse a 1-D NumPy array.
 - ii. Combine a one-dimensional array and a two-dimensional array.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Title of course: Major Elective Practical II
Advanced Linux Operating System Lab

Course Outcomes:

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

1. Understanding Nano editor in Linux Operating System.
2. Learn how to write Regular expression and pattern Linux commands.
3. Learn how to write filter commands.
4. Learn how to write BASH shell programming in Linux.

Following is a sample list of assignments for practical, subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes.

1. Write a shell script using grep command to print prime numbers between 1 to 30.
2. Write a shell script that checks given input is a valid email id.
3. Write a shell script to find whether the supplied user is working on network or not. If he / she is working then display his / her login time.
4. Write a shell script which accepts a file name as an input. Find out whether it is an ordinary file or directory. If a file is available then display all file access permissions on screen.
5. Write a shell script which copies files from one directory to another during copy command.
6. Create a data file which contains given format and perform the given operations on that data file using sed.
7. Write a shell script to copy a file using command line argument, source file must exist and be readable and target file must be a non-existing file name.
8. Write a shell script, which works similar to wc command, accept filename as command line argument.
9. Accept any word through command line argument and find out its length.
10. Write a shell script, which sorts an array of integers in ascending order.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V(Level- 5.5)
Title of course: VSC III (Major Specific) MERN Stack
Practical Based on VSC II (Major Specific)

Course Outcomes:

After completion of this course students will be able to:

1. Develop Node.js applications using asynchronous programming, events, streams, and file operations.
2. Implement database-driven applications using Node.js with MySQL and MongoDB.
3. Build Express applications using routing, middleware, templating engines, and RESTful APIs.
4. Design secure web applications with Express using sessions, cookies, and login–logout mechanisms.

Following is a sample list of assignments for practical, subject teachers are advised to provide more lab assignments to students to meet the course specified outcomes.

1. Write a Node.js program to demonstrate the use of the **REPL environment** and explain the **Event Loop** with an example.
2. Develop a Node.js application illustrating **asynchronous programming** using:
 - a. Callbacks
 - b. Promises
 - c. Async/Await
3. Write a Node.js program to implement **custom events** using the **EventEmitter module**.
4. Create a Node.js program that performs the following file operations using the **FS module**:
 - a. Read a file
 - b. Write to a file
 - c. Append data
 - d. Rename the file
 - e. Delete the file
 - f. (using both Sync and Async methods).
5. Develop a Node.js application demonstrating the use of **Buffers**.
6. Write a Node.js program that reads data using **Streams** and explains the concept of chunk-based processing.
7. Create a basic **HTTP Web Server** using the http module that handles client requests and responses.
8. Develop a Node.js application to process **POST request data** from an HTML form.
9. Write a Node.js program to implement **File Upload functionality** using Formidable or Multer.
10. Develop a Node.js application connecting to **MySQL** and performing CRUD operations.
11. Develop a basic **Express.js application** demonstrating the Request-Response cycle.
12. Write an Express.js program implementing **Routing** using:
 - GET
 - POST
 - PUT
 - DELETE
13. Create an Express.js application demonstrating the use of:
 - URL Parameters (req.params)
 - Query Strings (req.query)
14. Develop an Express.js application using **built-in middleware** for JSON and URL-encoded data.

15. Write an Express.js program implementing **Custom Middleware** and demonstrate the order of execution.
16. Develop an Express.js application using **Third-Party Middleware** such as:
 - CORS
 - Morgan
 - Body-Parser
17. Design and implement a **RESTful API** using Express.js and test endpoints using Postman/Insomnia.
18. Develop an Express.js application using the **EJS Template Engine** to render dynamic data with includes (partials).
19. Write an Express.js program to serve **Static Files** (CSS, Images, JS) from multiple directories.
20. Develop an Express.js application integrating **MongoDB using Mongoose**, implementing full CRUD operations.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: SEC III Artificial Intelligence

Course Outcome

After learning the course the students should be able to:

1. To understand the basics of Artificial Intelligence, Goals of A.I., Branches of A.I., Applications of A.I., Types of A.I.
2. To explain Intelligence in A.I., components of Intelligence
3. To learn Agents and environment with case study of self-driving car, explain concept of Search algorithm and terminologies.
4. To explain Types of Search Algorithms and understand Natural Language Processing.

UNIT-I Introduction to Artificial Intelligence

(15

Hours)

Introduction, Definition of Artificial Intelligence, Goals of A.I., Turing test. Branches of A.I. – 1) Machine Learning 2) Deep Learning. Applications of A.I., Advantages of A.I., Disadvantages of A.I. Types of Artificial Intelligence: 1) Type1 – Narrow A.I., General A.I., Super A.I. 2) Type2 – Reactive Machines, Limited Memory, Theory of Mind, Self-Awareness. What is intelligence, Definition of Intelligence, Types of Intelligence – Linguistic intelligence, Musical intelligence, Logical-mathematical intelligence, Spatial intelligence, Bodily-Kinesthetic intelligence, Intra-personal, Inter-personal intelligence Components of Intelligence- A] Reasoning: 1) Inductive reasoning, example 2) Deductive reasoning, example, B] Learning: 1) Rote Learning, 2) Generalized Learning- Supervised, Un-Supervised, Reinforcement Learning

UNIT-II Problem Solving in A.I

(15

Hours)

A.I. Agents and environment – concept, definition of agent, definition of environment, Structure of A.I. agent, case study, Rules for A.I. agent, Intelligent Agent- PEAS representation (Case study of Self Driving Car) examples. Concept, Search algorithm terminologies: i) Search- Search Space, Start State, Goal State. ii) Search Tree, iii) Actions, iv) Transition Model, v) Path Cost vi) Solution vii) Optimal Solution, viii) Problem and Problem Space. Types of Search Algorithms: Informed, Uninformed- Breadth First Search, Depth First Search Natural Language Processing: concept, overview of NLG & NLU

Reference Books:

1. Artificial Intelligence by- Mrs. Neeta Deshpande Technical Publications Pune.
2. Artificial Intelligence Making a system Intelligent by Dr. Nilakshi Jain.
3. Artificial Intelligence Elaine Rich and Kevin Knight, Tata McGraw Hill edition 3.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: AEC IV Professional Ethics & Corporate Skills

Course Outcomes

After completion of this course students will be able to

1. Explain the fundamental concepts of professional ethics, moral values, and codes of conduct relevant to corporate and professional environments.
2. Analyze ethical dilemmas using structured ethical decision-making frameworks, considering bias, empathy, and conflicts of interest.
3. Apply philosophical and psychological approaches to evaluate ethical behavior, integrity, courage, and emotional intelligence in professional life.
4. Assess ethical issues related to research, academics, intellectual property, confidentiality, employee rights, and workplace diversity.
5. Evaluate professional responsibilities related to safety, risk management, environmental protection, and sustainable development.
6. Demonstrate ethical leadership and corporate skills by analyzing CSR and sustainability case studies in national and global business contexts.

UNIT-I

(15 Hours)

Foundations of Ethics, Meaning and scope of ethics, Morals, values, and ethics: personal and professional, Individual vs professional ethics, Sense of professional and engineering ethics, Code of professional conduct (with reference to National Society of Professional Engineers), Ethical Decision Making, Ethical dilemmas and moral reasoning, Ethical decision-making models and roadmap, Bias, empathy, and internal obstacles, Conflict of interest and cultural relativism

UNIT-II

(15 Hours)

Business Ethics and Corporate Behaviour, Philosophical approaches to business ethics, Ethical issues in business and organizations, Ethical leadership and corporate governance, Resisting unethical authority and domination, Global business ethics, Psychological and Professional Perspectives, Psychological and philosophical approaches to ethics, Myths about morality, Courage, integrity, emotional intelligence, Ethics in research and academics: academic integrity and intellectual honesty, Ethics in the Workplace, Ethical issues in diverse workplaces, Employee rights, confidentiality, and discrimination, Sustainability and Corporate Skills, Ecology, engineering, and economy, Risk–benefit analysis and risk reduction, Corporate Social Responsibility (CSR), CSR in India and corporate sustainability

Reference Books-

1. Subramanian.R. Professional Ethics, Oxford Publication, 2013.
2. Nagarasan. R.S. Professional Ethics and Human Values. New Age International Publications, 2006.
3. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: IKS for Computer Science

Course Outcomes

After completing the course, students will be able to:

1. Plain core concepts and philosophy of Indian Knowledge Systems
2. Relate ancient Indian logic and mathematics to modern computer science
3. Apply IKS-inspired algorithms in computational problem-solving
4. Analyze the role of Sanskrit grammar in NLP and AI
5. Design ethical and sustainable AI systems using IKS principles
6. Evaluate real-world case studies integrating IKS with modern technology

UNIT- I

(15 Hours)

Definition and scope of Indian Knowledge Systems, Importance of ancient knowledge in contemporary science and technology, The IKS corpus: Vedas, Upanishads, Smritis, Sutras, Shastras, Objectives, nature, scope, and unique characteristics of IKS, Unique number representation systems: BhūtaSamkhya System, Kaṭapayādi System, Pingala's binary system (Laghu–Guru) and its importance in computing, Sanskrit phonetics and linguistics, Panini's Ashtadhyayi, Algorithmic nature of Paninian grammar, Role of Sanskrit in computational linguistics, Morphological analysis and syntax parsing,

UNIT- II

(15 Hours)

Applications: POS tagging, Machine translation, AI-driven language models for Indian languages, Knowledge pyramid and epistemology in IKS, Nyaya logic in knowledge representation, Pramana, Prameya, Samsasya as AI reasoning models, Ethical AI inspired by Indian philosophy, Sustainable and socially responsible AI systems.

Case Studies: Compiler Design, Recursion, Encryption Decryption, Computer Graphics, Algorithm Time Complexity, Binary Combinations, Vedic Mathematics for Signal Processing, Paninian Grammar for NLP and AI language models, Machine Learning inspired by Nyaya Logic

Reference Books-

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Bhartiya Knowledge Systems by M.C. Bora, Khanna Publishing House
3. Kautilya The Arthashastra. Translated by R. Shamasastri
4. Kapoor, Kapil, and Singh Avadesh Kumar, Indian Knowledge System Vol.1, DK Print World, Ltd., 2005.
5. Mahadevan B., Bhat V R, Nagendra Pavana R.N., Indian Knowledge System Concepts and Application, PHI Learning Pvt. Ltd., 2022.

B.Sc. Computer Science Entire
Multiple Entry and Multiple Exit Option(NEP-2020)
PART III SEM VI (Level- 5.5)
Title of course: Field Project (FP)

Course Outcomes:

After completion of this course students will be able to:

1. Identify real-world problems in industry, community, or research environments and define clear project objectives.
2. Apply theoretical knowledge and practical skills acquired during the program to solve field-based problems.
3. Collect, analyze, and interpret data using appropriate tools, techniques, and methodologies.
4. Demonstrate teamwork, leadership, communication, and professional ethics while working in real-time project environments.
5. Prepare structured project reports and deliver effective presentations showcasing findings, outcomes, and recommendations.
6. Evaluate project outcomes critically and suggest improvements or future enhancements based on practical experience.

Common Guidelines will be provided by Shivaji University, Kolhapur

Instructions For OJT and FP Report.

Document must be in Times New Roman font and with size 12.

Report includes Pages 30-50

1. Certificate
2. Index
3. Letter Of Completion
4. Declaration
5. Introduction
6. Theme Of Project
7. Motivation Of Project
8. Problem Statement
9. Method Used
10. Screen Shot
11. Conclusion
12. Future Enhancement
13. References

SCHEME OF EXAMINATION: -

- ✓ The Theory examination shall be conducted at the end of each semester.
- ✓ The Theory paper shall carry 40 Marks and Internal Evaluation carry 10 marks.
- ✓ The practical examination shall be conducted at the end of each Semester.
- ✓ The Practical paper of Major IX ,X, XI, XII shall carry 80 marks for practical assessment and 20 marks internal assessment (Practical and Viva).
- ✓ The Practical paper of Major Elective Subject 1 and Subject 2 shall carry 40 marks for practical assessment and 10 marks internal assessment (Practical and Viva).
- ✓ The VSC III and VSC IV(Major Specific) will conduct in practical mode only.
- ✓ The Practical paper of VSC III and VSC IV(Major Specific) shall carry 40 marks for practical assessment and 10 marks internal assessment (Practical and Viva).
- ✓ The Open Elective V subject will be choose from other faculty subject
 - basket.

- ✓ OJT (On Job Training) – Students shall must complete minimum 60 hours workout in semester V. Student must submit Joining Letter, OJT workout Report, Completion Certificate.
- ✓ The Practical Examination of OJT shall carry 80 marks for assessment of Report and 20 marks internal assessment (Practical and Viva).