D. Y. Patil Education Society

Deemed to Be University

School of Engineering and Management

KASABA BAWADA, KOLHAPUR

Accredited by NAAC with

‘A++’ Grade

Third Year B. Tech

Structure and Curriculum (as per NEP 2020)

Department of Computer Science and Engineering

Revised w. e. f. A. Y. 2026-27

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020)
B. Tech. Computer Science Engineering (SEMESTER- V)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	24CSEU5P01	PCC	Database Engineering	**3**	3	-	-	20	30	50	-	-	100
2	24CSEU5P02	PCC	Database Engineering Lab	**1**	-	2	-	-	-	-	25	25	50
3	24CSEU5P03	PCC	Design and Analysis of Algorithms	**3**	3	-	-	20	30	50	-	-	100
4	24CSEU5P04	PCC	Information Security	**3**	2	2	-	-	-	-	25	25	50
5	24CSEU5P05	PCC	Software Engineering	**2**	2	-	-	20	30	50	-	-	100
6	24CSEU5M06	MDM-III	Test Driven Development	**3**	3	-	-	20	30	50	-	-	100
7	24CSEU5M07	MDM-III	Test Driven Development Lab	**1**	-	2	-	-	-	-	25	-	25
8	24CSEU5E08	PEC-I	Internet of Things	**3**	**3**	-	-	**20**	**30**	**50**	-	-	**100**
9	24CSEU5E09		Computer Graphics and Multimedia Techniques										
10	24CSEU5E10		Introduction to AIML										
11	24CSEU5E11	PEC-I	Internet of Things Lab	**1**	-	**2**	-	-	-	-	**25**	-	**25**
12	24CSEU5E12		Computer Graphics and Multimedia Techniques Lab										
13	24CSEU5E13		Introduction to AIML Lab										
14	24CSEU5O14	OEC-III	Cloud Computing	**2**	2	-	-	-	-	50	-	-	50
15	24CSEU5C15	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
16	24CSEU5D16	AC	Finishing School Training - V	-	3*	-	-	-	-	-	50*	-	
			Total	**22**	**18**	**8**	**-**						**700**

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	24CSEU5Z01	Honors	Introduction to AI/ML	3	3	-	-	20	30	50	-	-	100
2	24CSEU5Z02	Honors	Introduction to AI/ML	1	-	2	-	-	-	-	25	-	25
3	24CSEU5Z03	Honors	Data Security Systems	3	3	-	-	20	30	50	-	-	100
4	24CSEU5Z04	Honors	Data Security Systems Lab	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course
#- Students opted AIML as Honors are not allowed to opt Introduction to AIML (PEC I)



Course Code:	24CSEU5P01
Course Name:	Database Engineering

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Set Theory, Operating System, Data Structures, Basic Software Engineering Concept (SDLC)

Course Description:

The Database Engineering course provides a comprehensive understanding of database systems and their role in the design, development, and management of information systems. It introduces students to database theory, architecture, design methodologies, query languages, and data modeling techniques.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamentals of Database Management Systems	9
CO2	Analyze the problem & construct good database design	9
CO3	Apply SQL queries to design & manage the database	9, 16
CO4	Understand Transactions Model and the Recovery Schemes in Database Management Systems	9, 16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2		1	3	1	1			1		2	2	1
CO2	2	2	2	2	2	3	2	3	2	3	3	2	3	3
CO3	2	2	2	2	2	3		1	1	1	1	1	3	3
CO4	1	3	2	3	3	3	1	1		1	2	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**INTRODUCTION TO DATABASES**	**6 Hours**	9, 16
Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Specialty Databases, Database Users & Administrators, Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, Relational Operations.			
Unit 2	**E-R MODEL AND DATABASE DESIGN**	**8 Hours**	9
E-R Model: The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams, Reduction to Relational Schemas **Normalization**: Data Redundancies & Update Anomalies, Functional Dependencies, The Process of Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form.			
Unit 3	**STRUCTURED QUERY LANGUAGE (SQL**	**7 Hours**	9, 16
Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested sub Queries, Modification of Databases.			
Unit 4	**DATA STORAGE & INDEXING**	**7 Hours**	9
File Organization, Organization of records in File, Data Dictionary Storage, Database Buffer, Basic Concepts indexing & hashing, Ordered Indices, B+ Tree Index files, Multiple-Key Access, Static Hashing.			
Unit 5	**TRANSACTION MANAGEMENT**	**8 Hours**	9, 16
Transaction Concept, A Simple Transaction Model, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Lock-Based Protocols, Deadlock Handling, Timestamp-Based Protocols, Validation-Based Protocols			
Unit 6	**RECOVERY SYSTEM**	**6 Hours**	9, 16
Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Failure with Loss of Nonvolatile Storage, Remote Backup Systems			

Text Books:

1. Database System Concepts, A. Silberschatz, H.F. Korth, S. Sudarshan, 6th Edition, Mc Graw Hill Education.
2. Database Systems - A practical approach to Design, Implementation and Management Thomos Connolly, Carolyn Begg, 3rd Edition, Pearson Education

Reference Books:

1.Database Systems – Design, Implementation and Management, Rob & Coronel 5th Edition, Thomson Course Technology
2.Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 4th Edition,Pearson Education



Course Code:	24CSEU5P02
Course Name:	Database Engineering Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Set Theory, Fundamental of Software Engineering (SDLC)

Course Description:

The Database Engineering course provides a comprehensive understanding of database systems and their role in the design, development, and management of information systems. It introduces students to database theory, architecture, design methodologies, query languages, and data modeling techniques.

Course Outcomes:	After the completion of the course the student will be able to -	SDG
CO1	Understand fundamentals of database management systems	4
CO2	Analyze & construct good database design	4
CO3	Apply SQL queries to design & manage the database	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		3	1	1			1	1	1		
CO2	1	3	2	3	2	3	1	3	1	1	3	2		
CO3	2	3	2	2	3	3	1	3	1	1	3	2		
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation (ISE)	50%	Assignments, Seminar, Presenatation etc.
2	POE	50%	POE

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Course Contents:	SDG
Assessment No. 1 : ER Model	4,9
Assessment No. 2 : Reduce above mentioned E-R Diagram into Relational Model	4,9
Assessment No. 3 : Normalize any database from first normal form to Boyce-Codd Normal Form (BCNF)	4,9
Assessment No. 4 :Use DDL Queries to create, alter (add, modify, rename, drop) & drop Tables	4,9
Assessment No. 5 : Use DML Queries to insert, delete, update & display records of the tables	4,9
Assessment No. 6 : Create table with integrity constraints like primary key, check, not null and unique	4,9
Assessment No. 7 : Create table with referential integrity constraints with foreign key, on delete cascade and on delete set null	4,9
Assessment No. 8 : Display the results of set operations like union, intersections & set difference	4,9
Assessment No. 9 : Display the results of Join Operations like cross join, self join, inner join, natural join, left outer join, right outer join and full outer join	4,9
Assessment No. 10 : Display the records using Aggregate functions like min, max, avg, sum & count. Also use group by, having clauses	4,9
Assessment No. 11 : Display the results using String operations	4,9
Assessment No. 12 : Create & Update views for any created table	4,9
Assessment No. 13 : Study of B+ tree indexing	4,9
Assessment No. 14 : Implement static hashing (Simulation)	4,9

Text Book:
1. Database System Concepts, A. Silberschatz, H.F. Korth, S. Sudarshan, 6th Edition, Mc Graw Hill Education.



Course Code:	24CSEU5P03
Course Name:	Design and Analysis of Algorithms

L	T	P	Credits
3			3

Course Prerequsites:

1. Problem Solving Approch
2. Data Structures

Course Description:

This course introduces the fundamentals of Design and Analysis of Algorithms, covering algorithm analysis, asymptotic notations, recursion, Divide and Conquer, Greedy Algorithms, Dynamic Programming, and Backtracking. It also explores key problems such as sorting, searching, shortest paths, knapsack, graph coloring, and N-Queens, along with the concepts of NP-Hard and NP-Complete problems.

Course Outcomes:	After the completion of the course the student will be able to -	SGDs
CO1	demonstrate an understanding of algorithms, their properties, and design techniques.	4,9
CO2	evaluate algorithm performance using asymptotic notations.	4,9
CO3	select the most appropriate algorithmic strategy for solving complex computational problems.	4,9
CO4	classify problems into polynomial, NP-Hard, and NP-Complete categories.	4,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				1			1					1	
CO2	2	1		1				1		1	1			
CO3		2	2	1	1					1		2	1	1
CO4	1	1		1						1	1	2		

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Introduction to Algorithms**	**7 Hours**	4, 9
Definition, Properties of Algorithms, Expressing Algorithm- Pseudocode; Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion			
Unit 2	**Divide and Conquer**	**7 Hours**	4,9
The general method, Binary search, Finding the maximum and minimum, Merge sort, Quick sort, Analysis of Divide and Conquer algorithms.			
Unit 3	**Greedy Algorithms**	**7 Hours**	4,8,9
Introduction to Greedy Technique, General Greedy Method, Knapsack Problem, Job Sequencing with Deadline, Optimal Merge Patterns, Minimum Spanning Tree - Prim's Algorithm, Kruskal's algorithm, Single-Source Shortest Path Algorithm			
Unit 4	**Dynamic Programming**	**7 Hours**	4,8,9
The general method, Longest Common Sub-sequence, Bellman Ford, All pair shortest paths, 0/1 knapsack, Traveling Salesperson problem.			
Unit 5	**Backtracking**	**7 Hours**	4,9
Backtracking Concept, N–Queens Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycle			
Unit 6	**NP Hard and NP Complete Problems**	**7 Hours**	4,9
Introduction, Polynomial Complexity Class, Non Polynomial Complexity Class- NP-Hard, NP-Complete			

Text Books:

1. Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, Fundamentals of Computer Algorithms Universities Press, Second Edition (All Units)

Reference Books:

1. Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, Pearson Education
2. Kyle Loudon, Mastering Algorithms with C, SPD O'Reilly
3. Allen Van Gelder , Sara Baase, Computer Algorithms- Introduction to Design and Analysis, Pearson Education



Course Code:	24CSEU5P04
Course Name:	Information Security

L	T	P	Credit
2		2	3

Course Prerequsites:

Computer Network, Data Communication, Engg. Mathematics

Course Description:

This course gives you practical survey of both the principles and practice of cryptography and network security. In the first part of course, the basic issues to be addressed by a network security capability are explored by providing a tutorial and survey of cryptography and network security technology. The later part of course deals with the practice of network security.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the use of Cryptographic algorithms to ensure data protection and integrity.	9,16
CO2	Apply the knowledge of cryptographic techniques to solve the problems on security.	9,16
CO3	Illustrate the different Network and Internet security protocols in TCP/IP stack.	9,16
CO4	Analyze the security facilities designed to provide system security.	9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1						2	2	2
CO2	2	3	3		2	2		2				2	2	2
CO3	1				2	2						2	2	2
CO4		2	2		3	3		2				2	2	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Evaluation	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	External Evaluation (OE)	50%	100% of course contents

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Course Contents:

Unit 1	**Introduction to Information Security**	**7 Hours**	**SDGs**
Computer Security Concepts: Information Security, Security Goals, CIA Triad, Computer Security Challenges. **OSI Security Architecture:** Security Attacks (Passive and Active), Security Services, Security Mechanisms, Model for Network Security. **Classical Encryption Techniques:** Symmetric Cipher Model, Caesar Cipher, Playfair Cipher, Transposition Cipher, Introduction to Steganography. **Case Study:** Encryption and Decryption using CrypTool.			4,9
Unit 2	**Symmetric and Asymmetric Key Cryptography**	**8 Hours**	
Symmetric Key Cryptography: Block Cipher Principles, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES (Overview), Applications of Symmetric Key Cryptography. **Public Key Cryptography:** Principles of Public Key Cryptosystems, RSA Algorithm, Diffie–Hellman Key Exchange, Applications of Public Key Cryptography. **Case Study:** Encryption and Decryption using OpenSSL.			9,16
Unit 3	**Authentication and Internet Security**	**8 Hours**	
Cryptographic Hash Functions: Applications of Hash Functions, Requirements of Hash Functions, Secure Hash Algorithm (SHA). **Message Authentication:** Message Authentication Codes (MAC), Hash-based Message Authentication Code (HMAC). **Digital Signatures:** Digital Signature Principles, Digital Certificates, Public Key Infrastructure (PKI). **Internet Security Protocols:** Secure Socket Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH), Pretty Good Privacy (PGP). **Case Study:** Digital Signature Generation and Verification using OpenSSL.			9,16
Unit 4	**Network Security and System Protection**	**7 Hours**	
Key Management: Symmetric Key Distribution, Public Key Distribution, Key Management Concepts. **Firewalls:** Firewall Characteristics, Types of Firewalls, Firewall Configuration. **Virtual Private Network:** VPN Concepts and Types of VPN. **Intrusion Detection System:** Introduction to IDS, Types of IDS, Basic Security Monitoring. **Security Tools:** Wireshark, VirusTotal and Introduction to SIEM. **Case Study:** Packet Capture and Analysis using Wireshark.			9,16

Reference Books:

Textbooks:

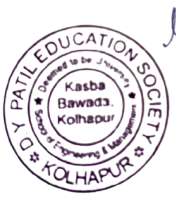
1. Williams Stallings – Cryptography and Network Security Principles and Practices (Unit 1 to 5)
Pearson Education (LPE), 7th Edition
2. Network Security, Firewalls, and VPNs, 3rd Edition by J. Michael Stewart, Denise Kinsey (Unit 6)

References:

1. Cryptography & Network Security B.A. Forouzan McGrawHill
2. Cryptography and network security – Atul Kahate (TMGH)
3. Handbook of Applied Cryptography - Menezes, an Oorschot, and S.A. Vanstone

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List of Practicals	SDGs
1 : Study of CrypTool and implementation of Caesar Cipher	4,9
2 : Implementation of Playfair Cipher and Transposition Cipher	4,9
3 : DES Encryption and Decryption using CrypTool/OpenSSL	9
4 : AES Encryption and Decryption	9
5 : RSA Key Generation, Encryption and Decryption	9
6 : SHA Hash Generation and Integrity Verification	9,16
7 : Digital Signature Generation and Verification using OpenSSL	9,16
8 : Packet Capture and Protocol Analysis using Wireshark	9,16
9 : SSL/TLS Handshake Analysis and HTTPS Traffic Inspection	9,16
10 : Firewall Configuration and Intrusion Detection using Windows Firewall/UFW (Demonstration)	4,9,16
11 : Study the Information Security Management System (ISO/IEC 27001) and the OWASP Top 10 Web Application Security Risks. Prepare a report describing the objectives, key security controls, common cyber threats, and best practices adopted by organizations to secure information systems.	16



Course Code:	24CSEU5P05		L	T	P	Credit
Course Name:	Software Engineering		2			2

Course Prerequsites:

Problem Solving Using C

Course Description:

This course gives you fundamentals of software development in the current IT industry. The fundamentals are divided into different parts. The first part deals with different software models followed for development of software. The subsequent parts deals with requirement specification, software design with UML, coding and testing respectively. You will get complete insight of software development process which will help you a lot in your career in IT industry

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Summarize the basic processes of software development and various SDLC models.	4,9
CO2	Analyze software requirements analysis and formulate design solution for a software.	9,4
CO3	Apply new software design techniques and technologies to bring out innovative solutions for the socital problems evolving into their continuous professional development.	9,11
CO4	Use knowledge of software testing approaches for verification and validation.	9,12

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										2			
CO2		1	2		1				3	3	1		1	2
CO3		1	1		2			1	3	3	2	3	3	2
CO4	1	1	1		2			1	3	2		3	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Software and Software Process**	**6 Hours**	4,9
The Problem Domain, SE Challenges, Software Process, Characteristics of a Software Process, Software Development Process Models- Waterfall Model, Prototype Methodology, Agile Software Development Methodology, Rapid Application Development (RAD), Spiral Model.			
Unit 2	**Software Requirement Analysis and Specifications**	**8 Hours**	9,4
Software Requirements, Problem Analysis, Requirements Specification, Functional Specifications with use cases, Validation, Design Principles, Module-Level Concepts, Design Notation and Specification, Structured Design Methodology, OO Analysis and Design Concepts.			
Unit 3	**UML Structural -Behavioral and Architectural Modeling**	**8 Hours**	9
Classes,Relationships, Diagrams and Class Diagrams,Advanced Classes, Advanced Relationships, Interfaces, Types, and Roles, Packages, Instances and Object Diagram Behavioral: Interactions, Use Cases, Use Case Diagrams, Interaction Diagrams, Activity Diagrams Architectural: Components, Deployment, Collaborations, Patterns and Frameworks, Component Diagrams, Deployment Diagrams			
Unit 4	**Coding and Testing**	**6 Hours**	9
Programming Principles and Guidelines, Coding Process, Refactoring, Verification, Metrics, Testing Fundamentals, Black-Box Testing, White-Box Testing.			

Text Books:

1. An Integrated approach to Software Engineering' –Pankaj Jalote, 3rd Edition, Narosa Publication. (1,2,3,6)
2. UML User Guide- Grady Booch, James Rumbaugh, Publisher: Addison Wesley (4,5)

Reference Books:

1. Software Engineering- A Practitioner's Approach – Roger S. Pressman (TMH) , ISBN-13: 978- 0071267823 ISBN-10: 0071267824
2. Software Engineering- Ian Sommerville – Pearson, 10th Edition, ISBN-13: 9780137503148
3. Software Engineering, Kogent Learning Solutions Inc., Dreamtech Press India Pvt. Ltd, ISBN: 9789350042663, 9789350042663

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Course Code:	24CSEU5M06
Course Name:	Test Driven Development

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Basic programming knowledge (any language)
Logical and analytical thinking
Familiarity with software development process

Course Description:

This course provides an in-depth introduction to Test-Driven Development (TDD) using Java and the JUnit framework. Students will learn how to develop robust, scalable, and maintainable software by writing tests before code. The course also covers core Java programming, object-oriented principles, strings, collections, and unit testing practices. By the end of the course, students will be able to apply TDD in real-world software projects with an emphasis on code quality and reliability.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the principles and process of Test-Driven Development along with its benefits and limitations.	4
CO2	Develop Java programs using core syntax, object-oriented concepts, and collections framework.	9
CO3	Design and implement unit tests using JUnit for ensuring code quality and correctness.	9
CO4	Integrate test-driven practices in software development, including writing tests first and refactoring code.	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	1
CO2	3	1	2	1	1	1					2		3	2
CO3	2	3		2	2	2							3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Introduction to Test driven development**	**6 Hours**	
Understanding the core principles of TDD, The benefits of TDD, Common misconceptions and limitations of TDD, Writing Effective Tests, Refactoring and Code Quality			4
Unit 2	**Introduction to Java Programming**	**8 Hours**	
Introduction to Java: History, features, and the Java Virtual Machine (JVM). Basic Syntax: Data types, variables, operators, control flow statements (if/else, loops)			4,9
Unit 3	**Object-Oriented Programming (OOP)**	**7 Hours**	
Working String and there functions, Regular expressions (regex), Working with Lists, Sets, Maps, and their implementations (ArrayList, HashMap, etc.).			9
Unit 4	**String and Collections Framework**	**7 Hours**	
Working String and there functions, Regular expressions (regex), Working with Lists, Sets, Maps, and their implementations (ArrayList, HashMap, etc.).			9
Unit 5	**Unit Testing - JUnit Testing**	**7 Hours**	
Importance of unit testing, Characteristics of good unit tests, Writing clear and concise test cases, What is Junit, Benefits of JUnit Testing in Java, Write test cases using Junit			9
Unit 6	**JUnit Framework**	**6 Hours**	
Benefits of JUnit Testing Framework, Features and Extensions, Set Up JUnit Testing, Annotations, JUnit Assertions,			9

Text Books:

1. "Test-Driven Development: By Example" Author: Kent Beck Publisher: Addison-Wesley
2. "Head First Java" (2nd Edition or later) Authors: Kathy Sierra and Bert Bates Publisher: O'Reilly Media
3. "Practical Guide to Testing in Java with JUnit" Author: Boni Garcia Publisher: Manning
4. "Clean Code: A Handbook of Agile Software Craftsmanship" Author: Robert C. Martin Publisher: Prentice Hall

Reference Books:

"JUnit in Action" (2nd Edition) Authors: Petar Tahchiev, Vincent Massol, Gary Gregory, and Felipe Leme

Oracle Java Documentation https://docs.oracle.com/javase/



Course Code:	24CSEU5E08
Course Name:	Internet of Things

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Computer Networks and Internet fundamentals, Programming skills in C/C++ or Python, Basic understanding of sensors and electronic components

Course Description:

This course introduces the fundamentals of the Internet of Things (IoT) and its integration with cloud computing. It covers IoT architecture, sensors, microcontrollers (Arduino, ESP32, Raspberry Pi), communication protocols, and cloud platforms such as AWS. Students will learn to interface devices, collect data, and use cloud services for storage and analytics. The course also explores real-world IoT applications in various domains and addresses challenges related to security, privacy, and ethics.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand the fundamental concepts, architecture, and enabling technologies of the Internet of Things (IoT).	9
CO2	Demonstrate the ability to interface sensors and actuators with microcontrollers and implement basic IoT applications.	9
CO3	Analyze the use of wireless communication protocols and cloud services in designing scalable IoT solutions.	9
CO4	Apply data handling and analytics techniques to IoT applications and examine real-world use cases and ethical considerations.	9, 11, 16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		2	3	2							3	1
CO2	3	1	2	1	1	1	1				2		3	2
CO3	2	3		2	2	2	3						3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Fundamentals of IoT**	**7 Hours**	**9**
Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M			
Unit 2	**IoT Physical Devices and Endpoints**	**8 Hours**	**9**
Microcontrollers, Introduction to Arduino board, various boards of Arduino. Arduino Uno : Arduino Uno Pin Layout, Arduino IDE, Arduino programming, ESP32 : ESP32 pin layout, advantages of ESP32 board, Interfacing sensors with microcontroller Raspberry-Pi : Introduction to Raspberry-Pi, installation of raspberry-pi, raspberry pi configuration,Introduction to Python, Interfacing sensors with raspberry pi.			
Unit 3	**Sensors and Protocol**	**7 Hours**	**9**
Sensors : Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Gas sensors, Temperature and Humidity Sensor , Motion Detection Sensors, Wireless Bluetooth Sensors,Level Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor, Biometric, Load, Flow, and pressure sensor Accuators: Actuators, Actuator Types, Actuator Characteristics. Protocol : Zigbee, Bluetooth and BLE, Cellular , LoRa and LoRaWAN, Wi-Fi, MQTT Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols			
Unit 4	**IoT Physical Servers and Cloud Offerings**	**7 Hours**	**9**
Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, AWS services for IoT			
Unit 5	**Data Handling& Analytics**	**7 Hours**	**9**
Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications			
Unit 6	**Applications of IoT**	**6 Hours**	**3, 7, 11, 13, 15, 16**
Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection, Security and challenges in IoT			

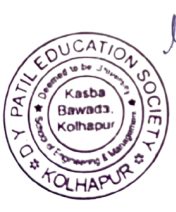
Text Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
3. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
5. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)"

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Reference Books:

1. Daniel Minoli, ― "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, platforms, and Use Cases", CRC Press
3. Internet of Things (A Hands-on Approach)" by Arshdeep Bahga and Vijay Madisetti
4. Introduction to IoT, Sudip Misra, Anandarup Mukherjee, Arjit Roy, CAMBRIDGE UNIVERSITY, PRESS.
5. Internet of Things Hanads on Approach, Ashdreep Bhaga, Vijay Midishetti, Universities Press



Course Code:	24CSEU5E09
Course Name:	Computer Graphics and Multimedia Techniques

L	T	P	Credit
3	0	0	3

Course Prerequsites:

1. Basic programming knowledge, Linear Algebra

Course Description:

This course provides a comprehensive introduction to the principles and applications of computer graphics and multimedia technologies. Students will learn about graphics systems, algorithms for rendering 2D and 3D graphics, animation techniques, and multimedia development.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamental computer graphics concepts and algorithms	4,9
CO2	Develop multimedia applications integrating various media types	4,9
CO3	Create basic animations and interactive graphics	4,9
CO4	Apply graphics and multimedia techniques to solve real-world problems	4,8,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				1							1	1
CO2	1	2	3	1	3	2				1	2		3	3
CO3	1	2	3	1	3	2				1	2		3	3
CO4	1	3	3	1	3	3				1	2		3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	An Introduction Graphics System	4 Hours	SDGs
Computer Graphics and Its Types, Application of computer graphics, Graphics Systems : Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations, Input Devices, Hard Copy Devices, Graphics Software.			4,9
Unit 2	**Geometric Transformations**	**10 Hours**	4,9
Basic Transformations, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing. Two-Dimension Viewing : The viewing Pipeline, Window to view port coordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping, Text Clipping, Exterior Clipping Three-Dimensional Concepts : Three Dimensional Display Methods, 3D Transformations, Parallel Proection and Perspective Projection			
Unit 3	**Raster Scan Graphics**	**7 Hours**	4,9
Line Drawing Algorithms, Circle Generating Algorithms, Scan-Line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood Fill Algorithm			

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Unit 4	**ILLUMINATION AND COLOR MODELS**	**7 Hours**	4,9
Light sources, Basic illumination models, Displaying light intensities, Halftone patterns and Dithering Techniques, Polygon Rendering methods, Ray tracing methods			
Unit 5	**MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING**	**7 Hours**	4,9
Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.			
Unit 6	**Animation**	**6 Hours**	4,8,9
Basics of Animation: Definition , Traditional Animation Techniques, Frame based Animation Techniques, Tweeking , Morphing, Computer Animation Tools : Hardware , Software ,Applications for Computer Animation			

Text Books:

1. Donald Hearn & M. Pauline Baker, "Computer Graphics with OpenGL", Third Edition, 2004, Pearson Education, Inc. New Delhi.
2. Ze-NianLi and Mark S. Drew, "Fundamentals of Multimedia", First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.
3. DP Mukherjee, Fundamentals of Computer Graphics and Multimedia, PHI

Reference Books:

1. Andleigh, P. K and KiranThakrar, ―Multimedia Systems and Design‖, PHI, 2003

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Code:	24CSEU5E10
Course Name:	Introduction to AIML

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Probability and Statistics, Programming skills, Data Structures and Algorithms

Course Description:

This course offers a comprehensive introduction to Artificial Intelligence, covering fundamental concepts such as knowledge representation, search strategies, logic-based reasoning, and learning algorithms. It explores classical and heuristic search methods, propositional and predicate logic, and key machine learning techniques including decision trees, neural networks, and reinforcement learning. The course also introduces probabilistic reasoning using Bayesian networks, equipping students with the theoretical and practical tools to design intelligent systems and solve complex real-world problems.

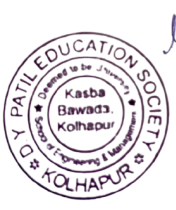
Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the main approaches to Artificial intelligence, Machine learning along with the limitations and challenges associated with AI and ML.	9,16
CO2	Apply AI concepts to solve real-world problems	11,9
CO3	Analyse and interpret data using AI techniques.	4,8

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	1
CO2	3	1	2	1	1	1					2		3	2
CO3	2	3		2	2	2							3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Introduction to Artificial Intelligence**	**6 Hours**	9,4
Introduction, what is AI, Strong Methods and weak Methods. Uses and Limitations, Knowledge Representation: Need for good representation, semantic nets, Frames, , Search Spaces, Semantics Tress, Search Trees, Combinatorial Explosion, Problem reduction, Goal Trees, Combinatorial Explosion.			
Unit 2	**Search Methodologies**	**8 Hours**	11,13,7
Introduction, Problem solving as search, Data driven or goal driven search, Generate and test, Properties of search methods, Depth First Iterative Deepening, Using Heuristics for Search, Hill Climbing, Best-First Search, Identifying Optimal Paths, Constraint Satisfaction search, Forward Checking, Local Search and Meta heuristics, Simulated Annealing. Genetic Algorithms for search, Real time A*, Bidirectional search, Nondeterministic search, non-chronological backtracking.			
Unit 3	**Prepositional and Predicate Logic**	**7 Hours**	16,9
Introduction, what is Logic, Why Logic is used in Artificial Intelligence, Logical Operators, translating between English and Logic Notation, The deduction Theorem, Soundness, Completeness, Decidability, Monotonicity, Abduction and Inductive reasoning, Modal logics and possible worlds, Dealing with change.			
Unit 4	**Introduction to Machine Learning**	**7 Hours**	8,3
Introduction, Training Rote Learning, Learning Concepts, General-to Specific Ordering, Version Spaces, Candidate Elimination, Inductive Bias, Decision-Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Backpropagation algorithms, Reinforcement Learning			
Unit 5	**Neural Networks:**	**7 Hours**	3,6
Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Recurrent Networks, Unsupervised Learning Networks, Evolving Neural Networks.			
Unit 6	**Probabilistic Reasoning and Bayesian Belief Networks**	**7 Hours**	2,13,15
Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes' Optimal Classifier, The Naïve Bayes Classifier.			

Text Books:

1. Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett, 2004.
2. Tom M. Mitchell, "Machine Learning", Mcgraw-Hill Education (Indian Edition), 2013.

Reference Books:

1. Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition 2013.
2. Stuart Russel, Peter Norvig: Artiificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013.
4. T Hastie, R. Tibshirani, J.H.Fiedman, "The Elements of statistical learning", Springer, 1st Edition 2001.

D.Y. PATIL EDUCATION SOCIETY
Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	24CSEU5E11
Course Name:	Internet of Things Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Computer Networks and Internet fundamentals
Programming skills in C/C++ or Python
Basic understanding of sensors and electronic components

Course Description:

This course introduces the fundamentals of the Internet of Things (IoT) and its integration with cloud computing. It covers IoT architecture, sensors, microcontrollers (Arduino, ESP32, Raspberry Pi), communication protocols, and cloud platforms such as AWS. Students will learn to interface devices, collect data, and use cloud services for storage and analytics. The course also explores real-world IoT applications in various domains and addresses challenges related to security, privacy, and ethics.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Configure and program microcontrollers like Arduino, ESP32, and Raspberry Pi by interfacing various sensors and actuators.	9
CO2	Connect IoT devices to cloud platforms and visualize sensor data.	9
CO3	Implement IoT communication using protocols like MQTT and HTTP.	9
CO4	Develop a mini-project applying IoT and cloud integration in a real-world use case.	9, 11, 13, 15

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	1
CO2	3	1	2	1	1	1					2		3	2
CO3	2	3		2	2	2							3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

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List of Experiments		SDGs
1	Study and setup of Arduino/ESP32 boards and basic programming using IDE	**9**
2	Interfacing LED and Push Button with Arduino/ESP32	**9**
3	Interfacing Temperature and Humidity sensor (e.g., DHT11) and displaying data	**9, 13**
4	Interfacing Ultrasonic sensor for distance measurement	**9**
5	Interfacing Gas sensor or Light sensor with ESP32/Arduino and displaying output	**9,13**
6	Interfacing with Actuators – DC Motor/Relay using Arduino/ESP32	**9**
7	Introduction to Raspberry Pi: OS Installation, Python Programming Basics	**9**
8	Sensor interfacing with Raspberry Pi and sending data over local network	**9**
9	Implementing communication between two IoT devices using MQTT protocol	**9**
10	Sending sensor data to cloud using ThingSpeak or Blynk platform	**9**
11	Using AWS IoT Core for device connection and real-time data visualization	**9**
12	Mini-project: Design and develop a complete IoT solution using microcontroller, sensors, cloud connectivity, and a simple dashboard for data monitoring	**9, 7, 11, 13**

Text Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014
3. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN :978-1- 84821-140-7, Wiley Publications
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things:Key Applications and Protocols", WileyPublications
5. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)",

Reference Books:

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. Internet of Things (A Hands-on Approach)" by Arshdeep Bahga and Vijay Madisetti
4. Introduction to IoT, Sudip Misra, Anandarup Mukherjee, Arjit Roy, CAMBRIDGE UNIVERSITY, PRESS.
5. Internet of Things Hanads on Approach, Ashdreep Bhaga, Vijay Midishetti, Universities Press



Course Code:	24CSEU5E12
Course Name:	Computer Graphics and Multimedia Techniques Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Basic programming knowledge, Linear Algebra

Course Description:

This laboratory course provides hands-on experience in implementing computer graphics algorithms and developing multimedia applications. Students will work with graphics programming, implement fundamental algorithms, create animations, and develop interactive multimedia systems.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Implement fundamental computer graphics concepts and algorithms	4
CO2	Develop multimedia applications integrating various media types	4,9
CO3	Create basic animations and interactive graphics	4,9
CO4	Apply graphics and multimedia techniques to solve real-world problems	4,8,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1			1								2	
CO2	1	2	2	1	3	2							3	3
CO3	1	2	2		3								3	3
CO4	2	3	3	3	3	3							3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Laboratory assignments, internal POE etc.

Course Contents:			SDGs
Experiment 1:	**Graphics System Setup and Basic Drawing**	**2 Hours**	4,9
Experiment 2:	**Implementation of 2D Transformations**	**2 Hours**	4,9
Experiment 3:	**Implemenation of Line drawing algorithm**	**2 Hours**	4,9
Experiment 4:	**Implementation of Circle drawing algorithm**	**2 Hours**	4,9
Experiment 5:	**Implementation of Polygon filling algorithms**	**2 Hours**	4,9
Experiment 6:	**Implementation of basic ray tracing algorithm.**	**2 Hours**	4,9
Experiment 7:	**Create a simple multimedia file converter that can convert between different image an**	**4 Hours**	4,9
Experiment 8:	**Create a simple database system to store and retrieve multimedia file information with basic search functionality.**	**4 Hours**	4,9
Experiment 9:	**Create a basic 2D animation tool that can generate simple animations using frame-bas**	**4 Hours**	4,8,9

Text Books:

1. David F. Rogers, J. Alan Adams, "Mathematical elements for Computer Graphics", MGH International
2. David F. Rogers, "Procedural elements for Computer Graphics", MGH International
3. Donald Hearn & M. Pauline Baker, “Computer Graphics with OpenGL”, Third Edition, 2004, Pearson Education, Inc. New Delhi.
4. Ze-NianLi and Mark S. Drew, “Fundamentals of Multimedia”, First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.

Reference Books:

1. Andleigh, P. K and KiranThakrar, ―Multimedia Systems and Design‖, PHI, 2003
2. Principles of Computer Graphics Theory and Practice Using OpenGL and Maya, Shalini Govil-Pai, (Springer) .
3. Computer Graphics (second Edition) - Zhigang Xiang & Roy Plastock (Schaum's Outline Series, TMGH).
4. Computer Graphics Using OpenGL F.S. Hill Jr. Stephen M. Kelley, (Pearson Education)

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR

Course Code:	24CSEU5E13
Course Name:	Introduction to AIML Laboratory

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Basics of Mathematics, Statistics etc.

Course Description:

This course offers a comprehensive introduction to Artificial Intelligence, covering fundamental concepts such as knowledge representation, search strategies, logic-based reasoning, and learning algorithms. It explores classical and heuristic search methods, propositional and predicate logic, and key machine learning techniques including decision trees, neural networks, and reinforcement learning. The course also introduces probabilistic reasoning using Bayesian networks, equipping students with the theoretical and practical tools to design intelligent systems and solve complex real-world problems.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Implement and evaluate various AI search algorithms and knowledge representation techniques for problem-solving applications.	9,11
CO2	Design and develop logic-based reasoning systems using propositional and predicate logic.	16,9
CO3	Build and analyze machine learning models for real-world datasets.	3,8

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2											3	3
CO2	3	2	2	2	3	3							3	3
CO3	3	3	3	3	3	3							3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Experiment 1:	Study of basic AI concepts and implement knowledge representation using semantic networks and frames.	2 Hours	4
Experiment 2:	Implement and analyze uninformed search algorithms for problem-solving.	2 Hours	11
Experiment 3:	Implement informed search algorithms using heuristics.	2 Hours	11,13
Experiment 4:	Implement logical reasoning systems using propositional and predicate logic.	2 Hours	16
Experiment 5:	Implement decision tree learning algorithm and analyze its performance.	2 Hours	8
Experiment 6:	Implement perceptron and multi-layer neural networks for classification tasks.	4 Hours	3
Experiment 7:	Implement Naive Bayes classifier and understand probabilistic reasoning in AI.	4 Hours	3
Experiment 8:	Implement K-means clustering algorithms	2 Hours	6,2
Experiment 9:	Implement Q-learning algorithm for reinforcement learning problems.	2 Hours	7

Text Books:

1. Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett, 2004.
2. Tom M. Mitchell, “Machine Learning”, Mcgraw-Hill Education (Indian Edition), 2013.

Reference Books:

1. Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition 2013.
2. Stuart Russel, Peter Norvig: Artiificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3. Ethem Alpaydin, “Introduction to Machine Learning”, 2nd Edition, PHI Learning Pvt. Ltd., 2013.
4. T Hastie, R. Tibshirani, J.H.Fiedman, “The Elements of statistical learning”, Springer, 1st Edition 2001.

D.Y. PATIL EDUCATION SOCIETY
Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	24CSEU5O14
Course Name:	Cloud Computing

L	T	P	Credit
2			2

Course Prerequsites:

Basic knowledge of computer networks, operating systems, and distributed systems.

Course Description:

This course introduces the fundamental concepts of cloud computing, including its architecture, service models, and deployment methods. It covers essential technologies such as virtualization, cloud infrastructure, and major cloud platforms like AWS, Azure, and Google Cloud. The course also explores cloud security, applications in various domains, and emerging trends enabling students to understand and apply cloud technologies in real-world scenarios.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamental concepts, architecture, and service models of cloud computing.	4,9
CO2	Analyze virtualization technologies and cloud infrastructure components.	7,12
CO3	Demonstrate the use of cloud platforms and assess security and application aspects in cloud environments.	3,4,9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2				1		1	2	1	1
CO2	3	3	1	3	3		1		1	2	2	2	3	2
CO3	3	2	1	3	3		2		1	2	2	2	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Evaluation [50 Marks]	100%	100% Course Contents

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Course Contents:			SDGs
Unit 1	**Introduction to Cloud Computing**	**7 Hours**	**4,9**
Definition, characteristics and benefits of cloud computing, history of cloud computing, types of clouds (public, private, hybrid), service models: IaaS, PaaS, SaaS, challenges and risks in cloud computing, cloud computing vs grid computing vs cluster computing.			
Unit 2	**Virtualization and Cloud Infrastructure**	**7 Hours**	**7,12**
Virtualization: concept, types, hypervisors (Type 1 and Type 2), virtual machines, server, storage, and network virtualization; Cloud infrastructure: architecture, data centers, scalability, elasticity, load balancing, containerization (Docker, Kubernetes).			
Unit 3	**Cloud Services and Platforms**	**7 Hours**	**8,9**
Cloud service providers: AWS, Microsoft Azure, Google Cloud; compute services (EC2, Azure VM), storage services (S3, Azure Blob), database services, cloud deployment models; APIs in cloud computing, monitoring and management tools.			
Unit 4	**Security, Applications and Future Trends**	**7 Hours**	**3,4,16**
Security in cloud: data security, privacy, identity and access management, encryption; compliance and legal issues; cloud applications in healthcare, education, IoT; cloud-native development; edge and fog computing, future trends in cloud.			

Text Books:

1. Mastering Cloud Computing - Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013
2. Cloud Computing - Principles and Paradigms - Buyya R, Broberg J, Goscinski A, Wiley,2011
3. Docker Cookbook - Sébastien Goasguen, O'reilly Nov. 2015 First Edition

Reference Books:

1. Cloud Computing Concepts, Technology & Architecture - Thomas Erl, Zaigham Mahmood, and Ricardo Puttini
2. Cloud Computing Bible - Barrie Sosinsky ,Wiley Publishing Inc. 2011
3. Cloud Native DevOps with Kubernetes – John Arundel and Justin Domingus
4. A to z on Docker: A complete Hands-On Guide to Docker Container – Swapnil Jain

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	24CSEU6P01		L	T	P	Credit
Course Name:	System Programing		3			3

Course Prerequsites:

Data Structures, Programming concepts.

Course Description:

This course explores the principles, algorithms, and data structures involved in the design and construction of compilers.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the structural architecture, characteristics, and core functions of various language processors and system	4,9
CO2	Analyze the complete lifecycle of software program execution, translation, linking, and loading mechanisms.	9
CO3	Illustrate the distinct operational phases of a compiler and their underlying data structures.	4,9
CO4	Design and implement functional modules for different compiler phases.	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				2						2			
CO2	1			1	1						1		2	1
CO3	1				2						1	1	3	1
CO4	1			1	2						1	1	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:			SDGs
Unit 1	**Language Processes & Assembler**	**8 Hours**	4,9
Introduction, language processing activities, Fundamentals of language processing, Fundamentals of language Specification Assemblers: Elements of assembly language programming, a simple assembly scheme, pass structure of assemblers, design of a two pass assembler.			
Unit 2	**Macros and Macro Processors**	**4 Hours**	9
Macro definition and call, Macro expansion, Nested macro calls, Advanced macro facilities, Design of macro pre-processor.			
Unit 3	**Phases in Compilers-Lexical Analysis & Syntax Analysis**	**10 Hours**	4,9
Role of a Lexical analyzer, input buffering, specification and recognition of tokens, Role of Parser, Writing grammars for context free environments, Top-down parsing- Recursive descent and predictive parsers (LL), Bottom-Up parsing			
Unit 4	**Syntax Directed Translation and Intermediate Code Generation**	**4 Hours**	9
Syntax directed definitions, construction of syntax tree, S-attributed definitions, L-attributed definitions.			
Unit 5	**Code Optimization**	**8 Hours**	9
Sources of optimization, Peephole optimization and basic blocks, loops in flow graphs, Data flow analysis and equations, code improving transformation and aliases			
Unit 6	**Code Generation**	**6 Hours**	9
Issues in design of a code generator and target machine, Run time storage management, Basic blocks and flow graphs, Next use information and simple code generator			

Text Books:

1. Systems Programming and Operating Systems- D.M. Dhamdhere, Second revised Edition, 2005, Tata McGraw- Hill Publishing Company limited, New Delhi.
2. Compilers - Principles, Techniques and Tools- A.V. Aho, R. Shethi and J.D. Ullman, Pearson Education.

Reference Books:

1. System Programming - J. J. Donovan (Mc-Graw Hill).
2. Compilers - Principles, Techniques and Tools- A.V. Aho, R. Shethiand J.D. Ullman, Addison Wesley Publishing Company.

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2024-25 (as per NEP-2020)
B. Tech. Computer Science Engineering (SEMESTER- VI)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	24CSEU6P01	PCC	System Programming	3	3	-	-	20	30	50	-	-	100
2	24CSEU6P02	PCC	Advanced Database Systems	3	3	-	-	20	30	50	-	-	100
3	24CSEU6P03	PCC	Advanced Database Systems Lab	1	-	2	-	-	-	-	25	25	50
4	24CSEU6P04	PCC	Smart Phone Application Development	3	2	2	-	-	-	-	50	50	100
5	24CSEU6M05	MDM-IV	Web Testing	2	2	-	-	-	-	50	-	-	50
6	24CSEU6E06	PEC-II	Programming Paradigms	3	3	-	-	20	30	50	-	-	100
7	24CSEU6E07		Ethical Hacking										
8	24CSEU6E08		Image Processing										
9	24CSEU6E09	PEC-II	Programming Paradigms Lab	1	-	2	-	-	-	-	25	-	25
10	24CSEU6E10		Ethical Hacking Lab										
11	24CSEU6E11		Image Processing Lab										
12	24CSEU6E12	PEC-III	FOSS Tools	3	3	-	-	20	30	50	-	-	100
13	24CSEU6E13		Blockchain Technology										
14	24CSEU6E14		Augmented Reality/ Virtual Reality										
15	24CSEU6E15	PEC-III	FOSS Tools Lab	1	-	2	-	-	-	-	25	-	25
16	24CSEU6E16		Blockchain Technology Lab										
17	24CSEU6E17		Augmented Reality/ Virtual Reality Lab										
18	24CSEU6N18	VSEC	Web Technology-II	2	1	2	-	-	-	-	25	25	50
19	24CSEU6D19	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	
20	24CSEU6C20	AC	Finishing School Training - VI	-	3*	-	-	-	-	-	50*	-	
			Total	**22**	**16**	**10**	**1**						**700**

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	24CSEU6Z01	Honors	Artificial Neural Networks	3	3	-	-	20	30	50	-	-	100
2	24CSEU6Z02	Honors	Artificial Neural Networks Lab	1	-	2	-	-	-	-	25	-	25
3	24CSEU6Z03	Honors	Ethical Hacking	3	3	-	-	20	30	50	-	-	100
4	24CSEU6Z04	Honors	Ethical Hacking Lab	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course

D Y PATIL EDUCATION SOCIETY Deemed to be University Kasba Bawada, Kolhapur School of Engineering & Management KOLHAPUR

Course Code:	24CSEU6P02
Course Name:	Advanced Database Systems

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Database Engineering Concepts

Course Description:

Advanced Database Engineering is an extension to database systems. Advanced database focuses and presents the features, benefits of advanced data models like Object oriented & Object relational models. Explores ahead the extension of SQL to PL/SQL to draw the benefits to the database designer & to the developer's community. This course covers NoSQL Databases like Key-Value Database, Document Database, etc.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand and Use the knowledge of PL/SQL in writing queries	4,9
CO2	Demonstrate the use of data mining & data warehousing techniques in business data analytics	8,9
CO3	Illustrate design, architectures, data storage, distribution &query processing in Parallel & distributed databases.	9
CO4	Construct a database using the SQL security features.	9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	1					1		2	2	1
CO2	2	3	2	1	3		2	2	1	3	3	2	3	3
CO3	2	3	2	1	3		2	1		1	1	1	3	3
CO4	2	2	1	2	2	2	2	3		1	2	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY ★ KOLHAPUR ★ Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Advanced SQL**	**7 Hours**	**SDGs**
Introduction to PL/SQL, PL/SQL Functions & Procedures, Oracle Sequences, Embedded SQL			4,9
Unit 2	**Object-Database Systems**	**6 Hours**	
Motivating Example, Structured Data Types, Operations on Structured Data, Encapsulation and ADTs, Inheritance, Objects aIDs, and Reference Types, Database Design for an ORDBMS,ORDBMS Implementation Challenges, OODBMS, Comparing RDBMS, OODBMS, andORDBMS			9
Unit 3	**NoSQL Database Management**	**7 Hours**	
Introduction, Data management with distributed databases, ACID and BASE NoSQL Types: Key-Value Database, Document Database, Column Family Database, and Graph Database Comparisonof relational databases and NoSQL			9
Unit 4	**Data Warehousing and Data Mining**	**8 Hours**	
DATA WAREHOUSING AND DECISION SUPPORT: Introduction to Decision Support, OLAP: Multidimensional Data Model, Multidimensional Aggregation Queries, Finding AnswersQuickly, Data Warehousing, Views and Decision Support, View Materialization. **DATA MINING:** Introduction to Data Mining, Counting Co-occurrences, Mining for Rules,Tree-Structured Rules, Clustering, Similarity Search over Sequences, Incremental Mining andData Streams, Additional Data Mining Tasks			8,9
Unit 5	**Parallel and Distributed Databases**	**8 Hours**	
Introduction, Architectures for Parallel Databases, Parallel Query Evaluation, ParallelizingIndividual Operations, Parallel Query Optimization, Introduction to Distributed Databases,Distributed DBMS Architectures, Storing Data in a Distributed DBMS, Distributed Catalog Management, Distributed Query Processing, Updating Distributed Data, Distributed Transactions,Distributed Concurrency Control, Distributed Recovery.			9
Unit 6	**Database Security**	**7 Hours**	
Introduction to Database Security Issues, Discretionary Access Control Based on Granting andRevoking Privileges, Mandatory Access Control and Role-Based Access Control for MultilevelSecurity, SQL Injection, Privacy Issues, and Preservation, Challenges of Database Security, OracleLabel-Based Security			9,16

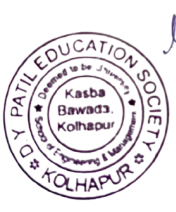
Text Books:

1. Oracle® PL/SQL™ by Example FOURTH EDITION BENJAMIN ROSENZWEIG ELENA SILVESTROVA RAKHIMOV(Unit : 1)
2. Database Management System - Raghu Ramakrishnan, Johannes Gehrke - MGH, [4e] (Units: 2,4,5)
3. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education(Unit-3)
4. Fundamentals of Database Systems -R. Elmasri S. B. Navathe - Addison Wesley-SixthEdition(Unit-6)



Reference Books:

1. Database System Concepts - Silberschatz, Korth, Sudarshan - MGH, 6th Edition
2. Data Mining - Margaret H. Dunham - Pearson Education
3. NoSQL Distilled: A brief guide to merging world of Polyglot persistence - Pramod J. Sadalage and Marin Fowler - Addison Wesley
4. Database Systems, Design, Implementation and Management - Coronel-Morris- Rob - Cengage Learning, [9e]



Course Code:	24CSEU6P03
Course Name:	Advanced Database Systems Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Set Theory, Fundamental of Software Engineering (SDLC)

Course Description:

The course develops hands-on skills in PL/SQL programming, database programming, Oracle database features, NoSQL databases, data warehousing, database security, object-relational concepts, and SQL operations through structured laboratory assessments and real-world applications.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamentals of database management systems	4,9
CO2	Analyze & construct good database design	4,9
CO3	Apply SQL queries to design & manage the database	4,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		3	1	1			1	1	1		
CO2	1	3	2	3	2	3	1	3	1	1	3	2		
CO3	2	3	2	2	3	3	1	3	1	1	3	2		
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Practical performance, Submission, Internal POE
2	External	50%	POE

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:		SDGs
Assessment No. 1 : Write a simple PL/SQL Program for the following i. Print the sum of “N” numbers ii. Check whether the input number is prime or not.	4 Hours	4,9
Assessment No. 2 : Implement & Demonstrate Declaring, Defining, and Invoking a Simple PL/SQL Function for the below statement. i. Find the Factorial of the number.	4 Hours	4,9
Assessment No. 3 : Implement a PL/SQL Procedure for the following i. Find a Maximum of three numbers using “IN” & “OUT” Parameters ii. Find the square of the Number using the “IN OUT” Parameter	2 Hours	4,9
Assessment No. 4 : Using Oracle Sequence demonstrate creating and dropping of an auto-number field for Customer Table.	2 Hours	4,8,9
Assessment No. 5 : Demonstrate NoSQL Key-Value Database.	2 Hours	4,9
Assessment No. 6 : Demonstrate No SQL Document Database.	2 Hours	4,9
Assessment No. 7 : Demonstrate Data Control Language Commands	2 Hours	4,9,16
Assessment No. 8 : Construct star schema. Demonstrate Fact and dimension tables	2 Hours	4,8,9
Assessment No. 9 : Examine SQL Injections.	4 Hours	4,9,16
Assessment No. 10 : Demonstrate Object-oriented& Object Relational databases.	2 Hours	4,9

Text Book:

1. Oracle® PL/SQL™ by Example FOURTH EDITION BENJAMIN ROSENZWEIG ELENA SILVESTROVA RAKHIMOV(Unit : 1)
2. Database Management System - Raghu Ramakrishnan, Johannes Gehrke - MGH, [4e] (Units: 2,4,5)
3. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education(Unit-3)
4. Fundamentals of Database Systems -R. Elmasri S. B. Navathe - Addison Wesley-SixthEdition(Unit-6)

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Code:	23CSEU6P04
Course Name:	Smart Phone Application Development

L	T	P	Credit
2	0	2	3

Course Prerequsites:

Basic programming knowledge

Course Description:

This course provides a comprehensive introduction to Kotlin for Android development, covering language basics, and advanced features. Students will explores user interface design with layouts and views, navigation using intents, dialogs, menus, and various Android storage options, including SQLite databases and content providers.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Learn the basics of Kotlin and how to use it for Android apps	4, 9
CO2	Understand how the Android system works and the main building blocks of apps	4, 9
CO3	Create user interface designs to demonstrate practical understanding of app layout and user navigati	4,9,10

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								1	1		3	1	
CO2	1	1	2		3			2	1	2			3	2
CO3	1	1	2		3			2	1	1		3	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Practical Oral Examination	50%	Practical/Oral Examination



Course Contents:

Unit 1	Introduction to Kotlin Programming Language	7 Hours	SDGs
Kotlin Basics: Kotlin Advantages, How Kotlin Program Work, Creating, Compiling and running Kotlin program, Input and Output, Kotlin Variables, Kotlin Data Types, operators, Type checks and casts, arrays, Control Flow statements, functions, Null safety. Object-Oriented Programming (OOP) in Kotlin: Object and Classes, constructors, overloading, Abstract Class, Interface, Sealed Class, Generic Class, Enum Class, Inner and anonymous Inner class. Non-Blocking Programming Techniques in Kotlin: Threading, Callbacks, Futures, promises, and others, Reactive Extensions, Coroutines. Advanced Kotlin Concepts: Kotlin collections, exception handling, Packages and Imports. Introduction to Kotlin Multiplatform			4,9
Unit 2	**Introduction to Android Application**	**8 Hours**	
Background: Evolution of Mobile Operating Systems, History of Android versions, Android OS architecture: Android OS Stack, Linux kernel, Native Libraries/DVM, Application Framework, Applications. **Android Application Components:** Activity, Fragments, Intents, BroadcastReceivers, Content Providers, Services Activities: Activity lifecycle, Activity Back Stack Fragments: Definition and purpose of Fragments, Fragment Lifecycle and its relationship with Activity lifecycle. Introduction to Android SDK Components of android SDK (sdk tools) Compilation, Building and running of android application **Creating a Android Project:** Project Directory Structure, Logging in Android (Logcat), Managing Exception with Logcat, Android Manifest File, Android Resources and Resource Directories, Permissions.			4,9
Unit 3	**Layouts**	**7 Hours**	
View Hierarchy: Android View and View Group classes and XML Elements, Layouts: Linear Layouts, Relative Layout, Table Layout, Frame Layout, Constraint Layouts, and their important properties. Padding and Margins with Layouts. Basic Views their properties and Events: TextView, Buttons & types, ImageView, EditText, CheckBox, ImageView, VideoView, GridView, RatingBar etc. Advanced Views: ListView, RecyclerView, Card View **Intents**: Implicit & Explicit Intents, Component of Intent, examples of some standard intents (Telephony, SMS etc), Android Intent Messaging via Intent Objects, Using Intents with Activities, pending Intents, Broadcast Receivers			4,9,10
Unit 4	**Dialogs, Menus and Storage**	**8 Hours**	
Dialogs: Components of Dialog, Alert Dialog, Seek Bar, Date Picker Dialog, Time Picker Dialog, Custom Dialogs **Menus**: Menu Inflators, Context Menu, Options Menu, Handling menu click events. **Android Storage Options:** Shared Preferences, Internal Storage, External Storage SQLite Databases: SQLite Database in your application, Installing SQLite plugin, DbHelper, The Database Schema and Its Creation, Four Major Operations of SQLite. SQLite databases and Content Providers: Creating an SQLite Database, querying an SQLite DB Table			4,9

Text Books:

1. Android Programming with Kotlin for Beginners" by John Horton
2. Programming Android with Kotlin by Pierre-Olivier Laurence, Amanda Hinchman-Dominguez, Mike Dunn, G. Blake Meike, O'Reilly Media, Inc.
3. Learn Kotlin for Android Development by Peter Späth , APress; 1st ed. edition



Experiment List

Exp. No.	Experiment Title	SDGs
1	Installation and setup of Kotlin, JDK, Android Studio, and execution of the first Kotlin program	4,9,10
2	Write Kotlin programs demonstrating variables, data types, operators, input/output, and type conversion	
3	Develop Kotlin programs using control statements, arrays, loops, and functions	
4	Implement Object-Oriented Programming concepts in Kotlin (classes, objects, constructors, inheritance, interfaces, abstract classes, sealed classes, enum classes, generic classes, inner and	
5	Develop Kotlin programs demonstrating collections, exception handling, null safety, packages, and coroutines for asynchronous programming	
6	Create a Kotlin Multiplatform project and explore project structure and shared code	
7	Install Android Studio, configure Android SDK, create and run the first Android application, and study project structure	
8	Explore Android application components by creating Activities, Fragments, and implementing Activity and Fragment lifecycle methods	
9	Demonstrate Intents (Explicit and Implicit), Broadcast Receivers, Services, and permissions using AndroidManifest.xml	
10	Design Android user interfaces using Linear, Relative, Frame, Table, and Constraint Layouts with common UI widgets	
11	Develop Android applications using RecyclerView, CardView, ListView, GridView, and implement event handling	
12	Implement Android Intent messaging, Pending Intents, and launch built-in applications (Phone, SMS, Browser, Email, Maps)	
13	Design Android applications using AlertDialog, Custom Dialog, DatePicker, TimePicker, SeekBar, and implement Options and Context Menus	
14	Develop Android applications using Shared Preferences, Internal Storage, and External Storage for data persistence	
15	Create an SQLite database application implementing CRUD operations and Content Provider for data sharing	

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	24CSEU6M05
Course Name:	Web testing

L	T	P	Credit
2	0	0	2

Course Prerequsites:

Basic understanding of software testing concepts (manual testing, SDLC)

Familiarity with Java programming

Fundamental knowledge of HTML, CSS, and browsers

Course Description:

This course introduces students to the principles and practices of automation testing in modern software development. It covers essential concepts including the benefits, limitations, and frameworks for automation testing. Students will gain practical experience using Selenium WebDriver, learn to write and manage automated test scripts using TestNG, and implement testing frameworks such as Page Object Model and Data-Driven testing. The course also integrates topics like continuous integration, reporting, and cross-browser testing to prepare students for real-world testing environments.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the principles, benefits, and types of automation testing and frameworks used in industry.	4,9
CO2	Develop and execute automated test scripts using Selenium WebDriver and TestNG framework.	4,9
CO3	Design and implement modular, reusable test automation frameworks with CI/CD integration and reporting tools.	9,17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			2	3	2							3	
CO2	3										2		3	2
CO3	2	3			2								3	3
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
4	End Semester Examination (ESE)	100%	100% course contents

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:			SDGs
Unit 1	**Introduction to Automation Testing**	**6 Hours**	4,9
What is automation testing?, Benefits and limitations of automation testing, Types of automation testing (e.g., functional, regression), Manual vs. Automation testing, Test automation frameworks (e.g., Data-Driven, Keyword-Driven, Page Object Model)			
Unit 2	**Selenium Fundamentals**	**8 Hours**	4,9,17
What is Selenium and its components (IDE, WebDriver, Grid), Selenium WebDriver architecture, Locating elements on a webpage (e.g., XPath, CSS selectors), Handling different browser types and versions, Working with various web elements (buttons, text boxes, dropdowns, etc.), Handling pop-ups, alerts, and frames			
Unit 3	**TestNG Framework**	**7 Hours**	4,9,17
Introduction to TestNG and its annotations, Writing test cases and test suites, TestNG listeners and reporting, Parallel test execution, and Data-driven testing with TestNG.			
Unit 4	**Framework Design**	**7 Hours**	9,17
Page Object Model (POM) design pattern, Keyword-driven framework, Data-driven framework, and Developing reusable test components, dependency management and build automation, continuous integration and continuous deployment (CI/CD), Logging and reporting using log4j or other tools, , Cross-browser testing			

Text Books:

1. Selenium WebDriver Practical Guide" Author: Unmesh Gundecha Publisher: Packt Publishing
2. TestNG Beginner's Guide" Author: Varun Menon Publisher: Packt Publishing
3. Learning Selenium Testing Tools with Python" (if using Java, refer for architecture concepts) Author: Unmesh Gundecha

Reference Books:

1. Effective Software Testing: A Developer's Guide" Author: Mauricio Aniche Publisher: Manning Publications
2. Continuous Integration: Improving Software Quality and Reducing Risk" Authors: Paul M. Duvall, Steve Matyas, and Andrew Glover Publisher: Addison-Wesley



Course Code:	24CSEU6E06
Course Name:	Programming Paradigms

L	T	P	Credit
3			3

Course Prerequsites:

Basic knowledge of data structures, object-oriented programming, and discrete mathematics is required.

Course Description:

This is one of the core course of Computer Science & Engineering Programme. In this course you will become familiar with the core concepts of OS - how OS work, how a processes & threads are created, inter-process communication & synchronisation, the various scheduling algorithms, memory management & memory allocation strategies, etc.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the principles, strengths, and limitations of various programming paradigms.	4
CO2	Apply imperative, object-oriented, functional, and logic programming techniques to solve computational problems.	4, 9
CO3	Analyze and compare programming paradigms based on problem requirements and performance considerations.	9
CO4	Design and implement multi-paradigm software solutions integrating concepts from different programming models.	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2									1	2	1	
CO2	2	2			2					1	2			
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Introduction**	**6 Hours**	
Definition and classification of programming paradigms, Historical evolution of programming languages Comparison of paradigms: strengths and limitations, Problem-solving approaches across paradigms, Language design principles and trade-offs			4
Unit 2	**Imperative Programming**	**8 Hours**	
Imperative programming model and state changes, Variables, assignment, and sequence control Structured programming principles, Procedures, functions, and parameter passing mechanisms, Memory management and pointer arithmetic, Control structures and iteration patterns Data Representation: The role of types, Basic types, Arrays, Records, Unions & Variant Records,Sets, Pointers.			4, 9
Unit 3	**Object-Oriented Programming**	**7 Hours**	
Advanced OOP concepts: polymorphism, inheritance hierarchies, Abstract classes and interfaces Design patterns: Singleton, Factory, Observer, Strategy SOLID principles in software design Exception handling and resource management Generic programming and templates			9
Unit 4	**Functional Programming**	**7 Hours**	
Functional programming philosophy and pure functions, Higher-order functions and function composition, Recursion patterns and tail recursion optimization, Immutability and persistent data structures, Lambda expressions and closures, Currying, partial application, and function combinators, Monads and functional error handling, Lazy evaluation and infinite data structures			9
Unit 5	**Logic Programming**	**7 Hours**	
Logic programming paradigm and declarative thinking, Predicate logic and Horn clauses, Unification and backtracking mechanisms, Cut operator and control in Prolog, List processing and recursive data structures, Constraint logic programming basics			9
Unit 6	**Concurrent and Parallel Programming**	**8 Hours**	
Concurrency vs parallelism concepts, Thread creation and synchronization primitives, Race conditions, deadlocks, and their prevention, Message passing and actor model, Parallel algorithms and data parallelism, Asynchronous programming patterns			9

Text Books:

1."Programming Language Pragmatics" by Michael L. Scott
2. "Concepts of Programming Languages" by Robert W. Sebesta

Reference Books:

1. "Modern Programming Languages: A Practical Introduction" by Adam Brooks Webber



Course Code:	24CSEU6E07
Course Name:	Ethical Hacking

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Set Theory, Operating System, Data Structures, Basic Software Engineering Concept (SDLC)

Course Description:

Ethical hacking course is designed to help learners to develop a deeper understanding of threats to information system. We hope learners will develop a lifelong passion and appreciation for ethical hacking, which we are certain will help in future endeavours. Students will benefit from this learning experience. Almost all aspects of security are covered in this course.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Define the basic concepts of components of Information and systems security.	4,9,16
CO2	Explain Footprinting, Reconnaissance, Network Scanning, Vulnerability Assessment, System Hacking, Malware Threats	4,9,16
CO3	Describe Sniffing and Social Engineering tools and techniques	4,9,16
CO4	Explain Sesion Hijacking, Firewall and IDS, Honeypot, Web Server and web applications security issues with SQL injection	4,8,9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												2	1
CO2	2				2			1					1	3
CO3	2				2			1					3	3
CO4	2				2			1					2	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:

Unit 1	**Introduction to Ethical Hacking**	**6 Hours**	**SDGs**
Essential Terminology, Elements of Information Security, The Security, Functionality, and Usability Triangle, Top Information Security Attack Vectors, Information Security Threat Categories, Types of Attacks on a System, Information Warfare, Hacking Concept and Scope, Vulnerability Assessment, Penetration Testing			4,9,16
Unit 2	**Footprinting and Reconnaissance**	**6 Hours**	
FootprintingConcept,Footprinting Methodology, Overview of Network Scanning, Scanning Methodology, Vulnerability Assessment Concept, System Hacking, Mulware Threats			4,9,16
Unit 3	**Sniffing and Social Engineering**	**8 Hours**	
Sniffing Concepts, MAC attacks,DHCP attacks,ARP Poisoning, Spoofing Attack,DNS Poisoning,Sniffing Tools,Social Engineering Concepts and Techniques,Impersonation on Social Networking Site, Identity Theft			8,9,16
Unit 4	**Session Hijacking and Firewall and Web Server**	**7 Hours**	
IDS and Firewall Concepts and System,Evading IDS,Firewall, Web Server Concepts and attacks, Attack Methodology,Countermeasures,Patch Management			8,9,16
Unit 5	**Web Application Hacking and SQL Injection**	**7 Hours**	
Web App concepts and attack methodology, Countermeasures ,SQL Injection methodology, SQL Injection Techniques			8,9,16
Unit 6	**Hacking Wireless Network and Mobile Platform**	**7 Hours**	
Wireless Concept,Wireless Encryption, Wireless Threats,Hacking Methodology, Bluetooth Hacking, Wireless Security Tool, Mobile Platform Attack Vector, Hacking Android, iOS ,Blackberry, Understanding IoT Attack			4,8,9,16

Text Books:

1. CEH V10: EC-Council Certified Ethical Hacker Complete Training Guide by IPSpecialist

Reference Books:

1. CEH v10 Certified Ethical Hacker Study Guide,Ric Messier, CEH, GCIH, GSEC, CISSP,SYBEX Publication



Course Code:	24CSEU6E08
Course Name:	Image Processing

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Basic knowledge of signals and systems, linear algebra, probability and programming in Python

Course Description:

This course introduces the principles and techniques of digital image processing, covering image acquisition, enhancement, restoration, segmentation, compression, and color processing, with practical applications using tools like Python

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Understand the basics of digital images and image acquisition.
CO2	Apply spatial and frequency domain techniques for image enhancement.
CO3	Perform image restoration and color image transformations.
CO4	Implement image segmentation, morphological operations, and compression methods.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	SDGs
CO1	3	2	2	2	2				1	2	1	1	3	3	4,9
CO2	3	3	2	3	2				1	2	2	1	3	3	9,3
CO3	3	2	2	2	2				1	2	1	1	3	3	9,3
CO4	3	2	2	2	2				1	2	2	1	3	3	3,9,11

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% Course Contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% Course Contents

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Course Contents:			SDGs
Unit 1	**Introduction to Digital Image Processing**	**6 Hours**	4,9
Fundamentals of image processing and computer vision, image sensing, acquisition and representation, sampling and quantization, basic relationships between pixels, imaging modalities: grayscale, color, binary			
Unit 2	**Image Enhancement in Spatial Domain**	**7 Hours**	3,9
Intensity transformations: contrast stretching, thresholding, histogram processing: equalization, matching, smoothing and sharpening filters (linear and non-linear), Laplacian and gradient-based enhancement			
Unit 3	**Image Enhancement in Frequency Domain**	**8 Hours**	9,3
Fourier Transform and DFT for images, frequency domain filtering: low pass, high pass, band pass, homomorphic filtering, Fast Fourier Transform (FFT)			
Unit 4	**Image Restoration and Color Processing**	**7 Hours**	3,9
Degradation model, noise models, restoration filters: inverse, Wiener, median, color image processing: RGB, HSV, HSI models, pseudocolor and full-color processing			
Unit 5	**Image Segmentation and Morphological Processing**	**8 Hours**	3,9,11
Edge detection: Sobel, Prewitt, Canny, thresholding, region growing, watershed segmentation, morphological operations: erosion, dilation, opening, closing, boundary detection and object representation			
Unit 6	**Image Compression and Applications**	**6 Hours**	3,9,11,13
Fundamentals of image compression, lossless vs lossy compression, Huffman coding, Run-Length encoding, JPEG compression, applications: medical imaging, satellite image processing, OCR			

Text Books:

1. Rafael C. Gonzalez & Richard E. Woods, Digital Image Processing, Pearson Education, 4th Edition
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image Processing, McGraw Hill Education

Reference Books:

1. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall
2. William K. Pratt, Digital Image Processing, Wiley
3. Bhabatosh Chanda & Dwijesh Dutta Majumder, Digital Image Processing and Analysis, PHI
4. Kenneth R. Castleman, Digital Image Processing, Pearson

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	24CSEU6E09
Course Name:	Programming Paradigms Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Fundamentals of Programming, Data Structures and Algorithms, Object-Oriented Programming, Operating Systems

Course Description:

This lab course focuses on hands-on implementation of various programming paradigms, including imperative, object-oriented, functional, and declarative. Students will design concurrent and distributed systems, apply design patterns, and integrate paradigms to build robust software solutions.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Apply different programming paradigms (imperative, object-oriented, functional, declarative) to solve problems.	4,9
CO2	Implement and analyze concurrent, parallel, and distributed programming using threads, actors, and synchronization.	9
CO3	Design and develop integrated software solutions combining multiple paradigms and design patterns.	4

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		3								1	
CO2	3	3	2	2	3								2	
CO3	3	2	3		3			2					2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation(Internal)	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

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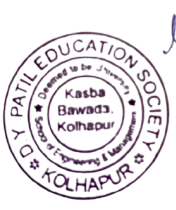
Experiment List		SDGs
1.	Implement a scientific calculator that supports basic arithmetic, trigonometric functions, and memory operat	4
2	Implement a dynamic data structure library in C containing: Dynamic array with automatic resizing Linked list with insertion, deletion, and search operations Hash table with collision handling Binary search tree with balancing	4, 9
3	Apply SOLID principles and implement design patterns in a real-world scenario.	4,9
4	Master functional programming concepts through practical implementation.	9
5	Build a file processing pipeline.	4,9
6	Develop proficiency in declarative logic programming	9
7	Implement thread-safe data structures and understand synchronization mechanisms.	9
8	Implement distributed systems using the actor model paradigm.	9
9	Design and implement parallel algorithms for computational problems.	9
10	Integrate multiple programming paradigms in a comprehensive software system.	4,9

Text Books:

1."Programming Language Pragmatics" by Michael L. Scott
2. "Concepts of Programming Languages" by Robert W. Sebesta

Reference Books:

1. "Modern Programming Languages: A Practical Introduction" by Adam Brooks Webber



Course Code:	24CSEU6E10
Course Name:	Ethical Hacking Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Computer Networks, Operating Systems, DBMS, and Programming Fundamentals.

Course Description:

This laboratory course provides hands-on experience in ethical hacking and cybersecurity techniques, including reconnaissance, vulnerability assessment, network analysis, web application security, SQL injection, wireless security, and mobile security. Students learn to identify security weaknesses and apply appropriate countermeasures in a controlled and ethical environment.

Course Outcomes:	After the completion of the course the student will be able to -	SDG
CO1	Apply ethical hacking techniques to perform reconnaissance, scanning, and vulnerability assessment of computer systems and networks.	4,9,16
CO2	Analyze network, web application, wireless, and mobile security vulnerabilities using appropriate security tools.	4,9,16
CO3	Recommend and implement security countermeasures to mitigate identified threats and vulnerabilities in a controlled environment.	8,9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		1	2			2					2	
CO2	1	2		3	2								2	
CO3		1	2			2		2	1	1				3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Evaluation [25 Marks]	100%	Experiment, Practical Performance and Oral Exam etc.

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List of Experiments:

1	Study of Information Gathering and Footprinting Techniques using WHOIS, DNS lookup, and search engines.	4,8,9, 16
2	Perform Network Scanning and Enumeration using Nmap to identify live hosts, open ports, and running services.	
3	Conduct Vulnerability Assessment of a target system using OpenVAS/Nessus and analyze the generated report.	
4	Capture and Analyze Network Traffic using Wireshark to study TCP, UDP, ICMP, HTTP, and DNS protocols.	
5	Demonstrate ARP Poisoning and Spoofing in a controlled lab environment and observe packet redirection.	
6	Analyze DHCP, DNS, and MAC-based attacks and study their detection and prevention mechanisms.	
7	Study Social Engineering Techniques by analyzing phishing emails, fake websites, and identity theft scenarios.	
8	Configure and Test Firewall and Intrusion Detection System (IDS) Rules using Windows Firewall/UFW and Snort.	
9	Perform Web Server Security Assessment using Nikto and identify common web server vulnerabilities.	
10	Analyze Common Web Application Vulnerabilities using DVWA/WebGoat and study security countermeasures.	
11	Perform SQL Injection Testing on a vulnerable web application and implement preventive measures using secure coding practices.	
12	Study Wireless, Mobile, and IoT Security by analyzing Wi-Fi security settings, Android application permissions, and common IoT attack vectors.	

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education.
2. Anil K. Jain, Fundamentals of Digital Image Processing, PHI Learning.
3. S. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, McGraw Hill Education.

Reference Books:

1. William K. Pratt, Digital Image Processing, Wiley
2. B. Chanda and D. Dutta Majumder, Digital Image Processing and Analysis, PHI
3. Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, Cengage
4. Kenneth R. Castleman, Digital Image Processing, Pearson

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	24CSEU6E11
Course Name:	Image Processing Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Basic knowledge of signals and systems, linear algebra, and programming in Python.

Course Description:

This laboratory course provides hands-on experience with fundamental and advanced image processing techniques. Students will implement methods for image acquisition, enhancement in spatial and frequency domains, restoration, segmentation, morphological processing, and compression. The course emphasizes practical applications such as medical imaging, satellite image analysis, and optical character recognition (OCR).

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Apply fundamental image processing techniques including acquisition, enhancement, and transformation.
CO2	Implement spatial and frequency domain methods for image enhancement and restoration.
CO3	Perform image segmentation, morphological processing, and basic compression techniques for practical applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	**SDGs**
CO1	3	2	2	3	2	2			1	1	3	1	3	3	4,9
CO2	3	3	2	3	3	2			1	1	3	1	3	3	3,9
CO3	2	2	2	3	3	3			1	1	3	1	3	3	3,9,15

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation [25 Marks]	100%	Experiment, Practical Performance and Oral Exam etc.

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List of Experiments:		SDGs
1	Perform basic image operations like grayscale conversion, resizing, and rotation.	4,9
2	Demonstrate image sampling and quantization with different resolutions	4,9
3	Apply histogram equalization to enhance image contrast.	3,9
4	Use mean and median filters for image smoothing.	3,9
5	Apply Laplacian and gradient filters for image sharpening.	3,9
6	Perform Fourier Transform and apply low-pass filtering in frequency domain.	4,9
7	Restore a noisy image using Wiener and inverse filtering.	3,9
8	Convert an image from RGB to HSV and apply pseudocolor mapping.	3,15
9	Detect edges using Sobel, Prewitt, and Canny operators.	4,9
10	Compress an image using Run-Length Encoding and Huffman Coding.	3,9

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education.
2. Anil K. Jain, Fundamentals of Digital Image Processing, PHI Learning.
3. S. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, McGraw Hill Education.

Reference Books:

1. William K. Pratt, Digital Image Processing, Wiley
2. B. Chanda and D. Dutta Majumder, Digital Image Processing and Analysis, PHI
3. Milan Sonka, Vaclav Hlavac, and Roger Boyle, Image Processing, Analysis, and Machine Vision, Cengage
4. Kenneth R. Castleman, Digital Image Processing, Pearson

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	24CSEU6E12
Course Name:	FOSS Tools

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Basic Programming Knowledge and Software Engineering Fundamentals

Course Description:

This course introduces students to Free and Open Source Software (FOSS) concepts and essential tools used in software development. Students will learn FOSS philosophy, version control, document preparation, web development stack, containerization, and study real-world FOSS projects.

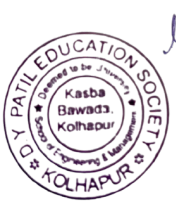
Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand FOSS philosophy and different software licensing models.	4, 16, 17
CO2	Use various FOOS tools like Git, docker, LaTeX.	4, 8, 9
CO3	Illustrate use of LAMP stack for web applications.	8, 9
CO4	Summarize successful FOSS projects and their development models.	4, 9, 17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	2	3		2					3	
CO2	1	1	2	1	3				2	2	1	3	3	2
CO3	1	1	2	1	3							3	3	2
CO4	1	3	3	3	3									

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**FOSS Philosophy and Licensing**	**6 Hours**	4, 9, 16, 17
Introduction to Free Software and Open Source Software. History of FOSS: GNU Project, Linux, Open Source Initiative. FOSS Philosophy: Four Freedoms, Benefits of Open Source. Software Licenses: Copyright basics, GPL, MIT, BSD, Apache License. License selection and compatibility. Legal aspects of FOSS.			
Unit 2	**Version Control with Git**	**8 Hours**	8, 9, 17
Introduction to Version Control Systems. Git basics: Repository, Working Directory, Staging Area. Basic Git commands: init, add, commit, status, log. Branching and Merging: Creating branches, switching branches, merging. Remote repositories: GitHub, clone, push, pull. Collaborative development: Pull requests, code reviews.			
Unit 3	**LaTeX Document Preparation**	**8 Hours**	4, 8, 9
Introduction to LaTeX: Advantages over word processors. Document structure: Document classes, packages, basic formatting. Text formatting: Sections, lists, emphasis. Mathematical equations and symbols. Including figures and tables. Bibliography and citations. Creating presentations with Beamer.			
Unit 4	**LAMP Stack**	**8 Hours**	8, 9, 17
Introduction to LAMP: Linux, Apache, MySQL, PHP. Apache Web Server: Installation, configuration, virtual hosts. MySQL Database: Basic SQL commands, database creation, user management. PHP Programming: Syntax, variables, functions, connecting to MySQL. Building a simple web application using LAMP.			
Unit 5	**Docker Containerization**	**8 Hours**	8, 9, 17
Introduction to Containers: Containers vs Virtual Machines. Docker basics: Images, containers, Docker Hub. Docker commands: run, build, pull, push. Creating Dockerfiles: Instructions and best practices. Docker Compose: Managing multi-container applications. Container deployment and management.			
Unit 6	**Case Studies and FOSS Projects**	**4 Hours**	4, 8, 9, 16
Success stories: Linux, Apache, MySQL, Firefox. FOSS development models: Community vs corporate projects. Business models: Red Hat, Ubuntu, MongoDB. Community aspects: Governance, contributions, documentation. Current trends in FOSS. Getting involved in FOSS projects.			

Text Books:

Unit 1: "Understanding Open Source and Free Software Licensing" - Andrew M. St. Laurent (O'Reilly Media)
Unit 2: "Pro Git" - Scott Chacon and Ben Straub (Apress) - Available online at git-scm.com
Unit 3: "LaTeX: A Document Preparation System" - Leslie Lamport (Addison-Wesley)
Unit 4: "Learning PHP, MySQL & JavaScript" - Robin Nixon (O'Reilly Media)
Unit 5: "Docker: Up & Running" - Karl Matthias and Sean P. Kane (O'Reilly Media)
Unit 6: "The Cathedral and the Bazaar" - Eric S. Raymond (O'Reilly Media)

Reference Books:

"Free Software, Free Society" - Richard M. Stallman (GNU Press)
"Version Control with Git" - Jon Loeliger and Matthew McCullough (O'Reilly Media)
"The LaTeX Companion" - Frank Mittelbach, Michel Goossens (Addison-Wesley)
"Web Development with Apache and PHP" - James Lee and Brent Ware (Manning Publications)
"Docker Deep Dive" - Nigel Poulton (Independent Publishing)



Course Code:	24CSEU6E13
Course Name:	Blockchain Technology

L	T	P	Credit
3			3

Course Prerequsites:

Basics of Programming, networks, and cryptography

Course Description:

This course introduces the fundamentals of blockchain technology and smart contracts. It covers the architecture, cryptographic principles, consensus mechanisms, and key platforms such as Bitcoin and Ethereum. Students will gain hands-on experience in writing and deploying smart contracts using Solidity. The course also explores real-world applications of blockchain across industries like finance, supply chain, and healthcare.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Describe the fundamentals, architecture, and types of blockchain systems.	4,9
CO2	Analyze cryptographic techniques and consensus mechanisms used in blockchain.	4,9,16
CO3	Develop smart contracts using Solidity and deploy them on Ethereum-like platforms.	4,8,9
CO4	Identify the solution to a real world problem using various blockchain platforms	4,9,16,17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				1				1	1	1			
CO2	2	2		1	2					1	2		1	
CO3	1	1	2	2	3			3		1	1	2	3	2
CO4	1	2	3	2	3	1	1	3	3	2	2	2	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:

Unit 1	**INTRODUCTION TO BLOCKCHAIN**	**6 Hours**	**SDGs**
Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain -History, Evolution of Blockchain, Definition, Need of Blockchain, Distributed Vs Centralized Vs Decentralized, Public Ledgers : Blockchain as Public Ledgers, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain, Benefits and Challenges of Blockchain Usages			4,9,16
Unit 2	**BLOCKCHAIN ARCHITECTURE**	**7 Hours**	
Operation of Bitcoin Blockchain, Blockchain Design Principles, Components of blockchain, Layered Architecture of Blockchain Ecosystem, Blockchain Architecture – Block, Hash, Distributed P2P, Merkle Tree, Structure of Blockchain- Types of Networks : Distributed Network , P2P Network, Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)etc. How Blockchain Works? Blockchain Demo - How Mining Works? (The NONCE and Cryptographic Puzzle) Immutable Ledger, Hard and Soft Forks, double spending			9,16
Unit 3	**CRYPTO CURRENCY**	**6 Hours**	
Bitcoin: Bitcoin and its History, Why use bitcoins? Where and how to buy bitcoins, Bitcoin transactions, How bitcoin transactions work, Bitcoin scripts and wallets. Ethereum: Ethereum Virtual Machine (EVM) – Wallets for Ethereum, Ethereum and Smart Contract, Solidity - Smart Contracts, Ether, Gas DApps , Decentralized Autonomous Organizations (DAO) Compare Bitcoin and Ether			8,9,16
Unit 4	**SMART CONTRACT AND SOLIDITY FUNDAMENTALS**	**7 Hours**	
Smart contracts, features of smart contract, types of Smart contract, advantages and challenges of smartcontract, Solidity: Introduction to solidity, Basic syntax, Data types, Operators, control flow, functions A programming structure in solidity			8,9
Unit 5	**SOLIDITY ADVANCED**	**7 Hours**	
Constructors, inheritance, abstract contracts, interfaces, events, mapping, error handling, libraries			4,8,9
Unit 6	**DIFFERENT BLOCKCHAIN FRAMEWORKS AND USE CASES**	**6 Hours**	
Study of Blockchain Frameworks: Hyperledger, IOTA, Corda, Multichain, Quorum etc. Different use cases of blockchain other than cryptocurrencies			8,9,16,17

Text Books:

1. Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media.
2. Imran Bashir, "Mastering BlockChain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication
5. Anshul Kaushik, "BlockChain and Crypto Currencies", Khanna Publishing House, Delhi

Reference Books:

1. Learn Ethereum: Build your own decentralized applications with Ethereum and smart contracts by by Xun (Brian) Wu , Zhihong Zou , Dongying Song

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Code:	24CSEU6E14
Course Name:	Augmented Reality/Virtual Reality

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Computer Graphics and Mathematics

Course Description:

This course provides comprehensive coverage of Augmented Reality (AR) and Virtual Reality (VR) technologies. Students will learn to develop AR/VR applications using industry-standard tools. The course imparts theoretical knowledge, preparing students for careers in the rapidly growing AR/VR industry across gaming, healthcare, education, and enterprise applications.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Demonstrate comprehensive understanding of AR/VR technologies and their applications	4,9
CO2	Apply computer vision techniques for tracking and recognition in AR systems	9
CO3	Create intuitive user interfaces for immersive 3D environments	3,9
CO4	Analyze current trends and future directions in AR/VR technology	4,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	3	2	1					1	3	2
CO2	2	1	1	1	3	1						1	3	3
CO3	1	1	2	1	2	2						1	3	3
CO4	1	2		2	3	3	2					1	2	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:			SDGs
Unit 1	**Introduction to AR/VR**	**6 Hours**	4,9
Definitions and Terminology: Virtual Reality (VR) fundamentals, Augmented Reality (AR) fundamentals, Mixed Reality (MR) and Extended Reality (XR), Difference between AR, VR, and MR Historical Development: Evolution of AR/VR technologies, Key milestones and breakthrough moments Types of Reality Systems: Immersive VR systems, Non-immersive VR systems, Marker-based and markerless AR, Location-based AR			
Unit 2	**Hardware and Software Architecture**	**8 Hours**	

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VR Hardware Components: Head-mounted displays (HMDs), Motion tracking systems, Input devices and controllers, Audio systems and haptic feedback, Graphics processing requirements AR Hardware Components: Cameras and sensors, Display technologies (optical see-through vs video see-through), Mobile AR platforms, Smart glasses and wearable devices Software Architecture: VR/AR development platforms and engines, Unity 3D for AR/VR development, Unreal Engine fundamentals, WebXR and browser-based solutions, Mobile AR frameworks (ARCore, ARKit) Performance Considerations: Frame rate and latency requirements, Optimization techniques, Memory management, Battery life considerations for mobile AR			9
Unit 3	**3D Graphics and Rendering for AR/VR**	**8 Hours**	
3D Graphics Fundamentals: 3D coordinate systems and transformations, Perspective and orthographic projections, Viewing transformations for VR, Stereoscopic rendering Lighting and Shading: Real-time lighting models, Shadow mapping techniques, Physically-based rendering (PBR), Environmental lighting for AR Texture Mapping and Materials: UV mapping and texture coordinates, Normal mapping and bump mapping, Material properties for realistic rendering, Procedural textures Optimization Techniques: Level of detail (LOD) systems, Occlusion culling, Frustum culling, Batching and instancing			9
Unit 4	**Computer Vision for AR Applications**	**8 Hours**	
Image Processing Fundamentals: Digital image representation, Image filtering and enhancement, Edge detection algorithms, Feature extraction techniques Marker-Based Tracking: Fiducial markers and QR codes, Marker detection algorithms, Pose estimation from markers, Marker design principles Markerless Tracking: Natural feature tracking, SLAM (Simultaneous Localization and Mapping), Plane detection and estimation, Object recognition and tracking Camera Calibration: Intrinsic and extrinsic parameters, Calibration procedures, Distortion correction, Multiple camera systems			9
Unit 5	**User Interface and Interaction Design**	**8 Hours**	
VR Interaction Paradigms: 3D user interface design principles, Gaze-based interaction, Hand tracking and gesture recognition, Voice commands and spatial audio, AR Interface Design, Spatial UI design principles, Occlusion and depth perception, Touch and gesture interfaces, Context-aware interfaces Human Factors and Ergonomics: Motion sickness and cybersickness, Visual comfort and eye strain , Accessibility considerations, User experience evaluation methods, Interaction Techniques: Selection and manipulation in 3D space, Navigation and locomotion in VR, Menu systems and information display, Collaborative and multi-user interfaces			3,9
Unit 6	**Applications and Emerging Trends**	**4 Hours**	
Industry Applications: Medical visualization and surgical training, Architectural visualization and design, Industrial training and maintenance, ducational simulations and learning environments Emerging Trends: Social VR and metaverse concepts, AI integration in AR/VR, Cloud-based AR/VR solutions, Haptic feedback and sensory integration			3,4,9

Text Books:

1. "Virtual Reality Technology" by Grigore C. Burdea and Philippe Coiffet
2. "Augmented Reality: Principles and Practice" by Dieter Schmalstieg and Tobias Hollerer

Reference Books:

1. "Learning Virtual Reality" by Tony Parisi
2. "Augmented Reality for Developers" by Jonathan Linowes and Krystian Babilinski
3. "Unity in Action" by Joe Hocking
4. "Real-Time Rendering" by Tomas Akenine-Möller, Eric Haines, and Naty Hoffman

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Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	24CSEU6E15
Course Name:	FOSS Tools Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Students should have basic knowledge of computer operations, programming concepts, and the Linux operating system. Familiarity with command-line usage and basic software installation will help students perform the laboratory exercises effectively.

Course Description:

This course introduces students to Free and Open Source Software (FOSS) concepts and essential tools used in software development. Students will learn FOSS philosophy, version control, document preparation, web development stack, containerization, and study real-world FOSS projects.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand FOSS philosophy and different software licensing models.	4, 16, 17
CO2	Use various FOOS tools like Git, docker, LaTeX.	4, 8, 9
CO3	Demonstrate use of LAMP stack for web applications.	8, 9
CO4	Summarize successful FOSS projects and their development models.	4, 9, 17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	2	3		2					3	
CO2	1	1	2	1	3				2	2	1	3	3	2
CO3	1	1	2	1	3							3	3	2
CO4	1	3	3	3	3									

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In-Semester Evaluation	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

Experiment List		SDGs
Assignment 1	Understand the legal aspects, copyright basics, and compatibility profiles of major open-source licenses (GPL, MIT, BSD, Apache).	4, 9, 16, 17
Assignment 2	Master local Git architecture (Working Directory, Staging Area, and Local Repository).	4, 8, 9
Assignment 3	Collaborative Git Workflows, Branching, and Conflict Resolution.	8, 9, 17
Assignment 4	Technical Document Layout and Mathematical Typesetting using LaTeX.	4, 8, 9
Assignment 5	Automated Academic Bibliography Management and Beamer Presentations.	4, 8, 9, 17
Assignment 6	Install, customize, and configure an isolated Linux-Apache-MySQL-PHP hosting subsystem.	8, 9
Assignment 7	Docker Containerization Basics.	8, 9, 17
Assignment 8	Custom Microservice Containerization using Dockerfiles.	8, 9, 17

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Course Code:	24CSEU6E16
Course Name:	Blockchain Technology Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Basics of Programming, networks, and cryptography

Course Description:

This course introduces the fundamentals of blockchain technology and smart contracts. It covers the architecture, cryptographic principles, consensus mechanisms, and key platforms such as Bitcoin and Ethereum. Students will gain hands-on experience in writing and deploying smart contracts using Solidity. The course also explores real-world applications of blockchain across industries like finance, supply chain, and healthcare.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Write, deploy, and test smart contracts using Solidity on Ethereum	4,9
CO2	Set up and configure blockchain development environments and tools.	4,9
CO3	Develop mini DApps integrating smart contracts for real-world use cases.	4,8,9
CO4	Simulate blockchain transactions and interactions using decentralized tools.	4,8,9,16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				3			2		1	1			
CO2	1	2			2			1		1	2		1	
CO3	1	1	2	1	3			2		1	2	2	2	2
CO4	1	2		1	1					1	2	1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

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Experiment List		SDGs
1	Introduction to Blockchain simulators and tools (Ganache, MetaMask, Remix IDE)	**4,8,9,16**
2	Setting up Ethereum blockchain environment using Ganache and connecting with MetaMask	
3	Creating and deploying a basic smart contract using Solidity in Remix	
4	Writing a smart contract for a voting system	
5	Implementing a smart contract for a crowdfunding platform	
6	Demonstrating a cryptocurrency transfer between accounts using smart contract	
7	Managing ownership and access control in smart contracts	
8	Testing smart contracts with Truffle framework (optional advanced)	
9	Mini project: Develop a DApp with front-end integration	

Text Books:

1. Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media.
2. Imran Bashir, "Mastering BlockChain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012
3. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
4. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication
5. Anshul Kaushik, "BlockChain and Crypto Currencies", Khanna Publishing House, Delhi

Reference Books:

1. Learn Ethereum: Build your own decentralized applications with Ethereum and smart contracts by by Xun (Brian) Wu , Zhihong Zou , Dongying Song

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Course Code:	24CSEU6E17
Course Name:	Augmented Reality/Virtual Reality Laboratory

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Computer Graphics and Mathematics

Course Description:

This laboratory course provides hands-on experience with Augmented Reality (AR) and Virtual Reality (VR) technologies. Students will develop practical skills in creating AR/VR applications using industry-standard tools and frameworks.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Implement and demonstrate AR/VR applications using various development platforms	9
CO2	Develop computer vision-based tracking systems for marker-based and markerless AR applications	9
CO3	Design and implement intuitive 3D user interfaces with interaction techniques for immersive environments	3,9
CO4	Create and evaluate AR/VR applications for real-world scenarios	3,4,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3		3	2							3	3
CO2	3			1	3								3	3
CO3	1		3		3	2							3	3
CO4	1	3		3	3	3							3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	100%	Practical performance, Internal POE



Course Contents:			SDGs
Experiment 1:	**Introduction to Unity 3D for AR/VR Development**	**2 Hours**	4,9
Experiment 2:	**Marker-Based AR Application Development**	**2 Hours**	9
Experiment 3:	**Markerless AR with Plane Detection**	**2 Hours**	9
Experiment 4:	**3D Graphics Rendering and Optimization**	**2 Hours**	9
Experiment 5:	**VR Interaction Systems**	**2 Hours**	9
Experiment 6:	**Computer Vision for AR Tracking**	**2 Hours**	9
Experiment 7:	**AR/VR User Interface Design**	**2 Hours**	3,9
Experiment 8:	**Medical AR Visualization**	**4 Hours**	3,9
Experiment 9:	**Educational VR Application**	**4 Hours**	3,9

Text Books:

1. "Virtual Reality Technology" by Grigore C. Burdea and Philippe Coiffet
2. "Augmented Reality: Principles and Practice" by Dieter Schmalstieg and Tobias Hollerer

Reference Books:

1. "Learning Virtual Reality" by Tony Parisi
2. "Augmented Reality for Developers" by Jonathan Linowes and Krystian Babilinski
3. "Unity in Action" by Joe Hocking
4. "Real-Time Rendering" by Tomas Akenine-Möller, Eric Haines, and Naty Hoffman



Course Code:	24CSEU6N18
Course Name:	Web Technology-II

L	T	P	Credit
1		2	2

Course Prerequsites:

Basic Programming Knowledge, Basic knowledge of HTML, CSS, and JavaScript, Introduction to Java, Basic knowledge of relational databases

Course Description:

This course provides comprehensive training in building full-stack web applications using React for the frontend and Spring Boot for the backend. Students will learn to design responsive user interfaces, develop RESTful APIs, and integrate both ends to create modern web applications. Emphasis is placed on component-based development, routing, state management, secure API development, and deployment.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Design and implement dynamic user interfaces using React and its component-based architecture.	4,9,10
CO2	Develop secure and scalable backend services using Spring Boot and RESTful APIs.	4,9,16
CO3	Integrate frontend and backend technologies to build full-stack web applications.	4,8,9,10
CO4	Deploy and test full-stack applications with effective state management and secure API communication.	4,8,9,10

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1										1			
CO2	1	2			2					1	2		1	
CO3	1	1	2	1	3			2				2	2	2
CO4	1	2		1	1							1	2	

Assessment Scheme:

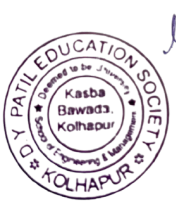
SN	Assessment	Weightage	Remark
1	In Semester Evaluation	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Introduction to React**	**4 Hours**	
Introduction to SPA and React.js JSX and Virtual DOM Functional Components and Props State and Lifecycle Methods Handling Events in React Conditional Rendering and Lists Forms and Input Handling Lifting State Up			4,8,9,10
Unit 2	**Advanced React Features**	**4 Hours**	
React Hooks: useState, useEffect Context API and Custom Hooks React Router: Navigation, Route Parameters, Nested Routing Global State Management: useReducer, Context API Introduction to Redux (optional) API Calls using Axios / Fetch Error Handling and Loading States			4,8,9,10
Unit 3	**Introduction to Spring Boot**	**4 Hours**	
Overview of Spring Framework and Spring Boot Spring Boot Architecture and Dependencies (Maven/Gradle) Building REST APIs with Spring Boot Annotations: @RestController, @RequestMapping, @PathVariable, @RequestBody Exception Handling in APIs Spring Data JPA and Hibernate CRUD Operations using Repositories Connecting to MySQL/PostgreSQL			4,8,9,16
Unit 4	**Advance Spring Boot**	**4 Hours**	
Spring Boot Security Basics (JWT/OAuth2 overview) Role-Based Access Control (RBAC) Connecting React Frontend with Spring Boot Backend Handling CORS and API Authentication Environment Configuration and .env files Deployment of application Project: Full-stack CRUD application with secure login			8,9,16

Text Books:

1. Full Stack Development with Spring Boot 3 and React byJuha Hinkula Packt Publishing; 4th edition
2. Learning Spring Boot 3.0: Simplify the development of production-grade applications using Java and Spring by Greg L. Turnquist Dave Syer Mark Heckler Josh Long



Experiment List		SDGs
1	Setup React Development Environment (Node.js, npm, VS Code) and create a basic React app	
2	Create React components using JSX, Props, and State	
3	Build forms in React and handle form events and validations	
4	Implement routing in React using React Router	
5	Use React Hooks (useState, useEffect) for state and side effects	
6	Setup Spring Boot project using Spring Initializr and build a basic REST API	
7	Develop CRUD operations using Spring Boot and MySQL/PostgreSQL	4,8,9,10,16
8	Implement exception handling and validation in Spring Boot APIs	
9	Connect React frontend with Spring Boot backend using Axios	
10	Implement user login and role-based authentication (Spring Security + JWT)	
11	Manage environment variables and integrate .env in frontend/backend	
12	Final mini-project: Develop and deploy a full-stack web app (e.g., Task Manager, E-Commerce Admin, Event Manager)	



D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2023-24 (as per NEP-2020)
B. Tech. Computer Science Engineering (SEMESTER- VII)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	23CSEU7P01	PCC	Advanced Database Systems	**3**	3		-	20	30	50		-	100
2	23CSEU7P02	PCC	Advanced Database Systems Lab	**1**		2					25	25	50
3	23CSEU7P03	PCC	Software Testing and Quality Assurance	**2**	1	2	-	-	-	-	25	25	50
4	23CSEU7M04	MDM-V	API Testing	**2**	2	-	-	-	-	50	-	-	50
5	23CSEU7E05	PEC-IV	Cyber Security	3	3	-	-	20	30	50	-	-	100
6	23CSEU7E06		Artificial Neural Network										
7	23CSEU7E07		Mobile Technology										
8	23CSEU7E08	PEC-V	Business Intelligence and Analysis	3	3	-	-	20	30	50	-	-	100
9	23CSEU7E09		Computer Vision										
	23CSEU7E10		Natural Language Processing										
10	23CSEU7E11		Software Defined Network										
11	23CSEU7R11	RM$	Research Methodology	**4**	4	-	-	20	30	50	-	-	100
12	23CSEU7J12	PR	Project	**4**	-	8	-	-	-	-	75	75	150
13	23CSEU7D13	AC	Liberal Learning	-	2*	-	-	-	-	-	50*	-	0
			Total	**22**	**14**	**12**	**-**						**700**

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	23CSEU7Z01	Honors	Deep Learning	3	3	-	-	20	30	50	-	-	100
2	23CSEU7Z02	Honors	Deep Learning Lab	1	-	2	-	-	-	-	25	-	25
3	23CSEU7Z03	Honors	Cyber-crime and Laws	3	3	-	-	20	30	50	-	-	100
4	23CSEU7Z04	Honors	Cyber-crime and Laws Lab	1	-	2	-	-	-	-	25	-	25

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course
#- Students opted Cyber Security as Honors are not allowed to opt Foundations of Cyber Security (PEC IV)

D.Y. PATIL EDUCATION SOCIETY (Deemed to be University) Kasba Bawada, Kolhapur School of Engineering & Management KOLHAPUR

Course Code:	23CSEU7P01
Course Name:	Advanced Database Systems

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Database Engineering Concepts

Course Description:

Advanced Database Engineering is an extension to database systems. Advanced database focuses and presents the features, benefits of advanced data models like Object oriented & Object relational models. Explores ahead the extension of SQL to PL/SQL to draw the benefits to the database designer & to the developer's community. This course covers NoSQL Databases like Key-Value Database, Document Database, etc.

Course Outcomes:	After the completion of the course the student will be able to -	**SDGs**
CO1	Understand and Use the knowledge of PL/SQL in writing queries	4
CO2	Demonstrate the use of data mining & data warehousing techniques in business data analytics	9
CO3	Illustrate design, architectures, data storage, distribution &query processing in Parallel & distributed databases.	9
CO4	Construct a database using the SQL security features.	16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	1					1		2	2	1
CO2	2	3	2	1	3		2	2	1	3	3	2	3	3
CO3	2	3	2	1	3		2	1		1	1	1	3	3
CO4	2	2	1	2	2	2	2	3		1	2	1	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Advanced SQL**	**6 Hours**	9
Introduction to PL/SQL, PL/SQL Functions & Procedures, Oracle Sequences, Embedded SQL			
Unit 2	**Object-Database Systems**	**6 Hours**	9
Motivating Example, Structured Data Types, Operations on Structured Data, Encapsulation and ADTs, Inheritance, Objects aIDs, and Reference Types, Database Design for an ORDBMS,ORDBMS Implementation Challenges, OODBMS, Comparing RDBMS, OODBMS, andORDBMS			
Unit 3	**NoSQL Database Management**	**7 Hours**	9
Introduction, Data management with distributed databases, ACID and BASE NoSQL Types: Key-Value Database, Document Database, Column Family Database, and Graph Database Comparisonof relational databases and NoSQL			
Unit 4	**Data Warehousing and Data Mining**	**8 Hours**	8
DATA WAREHOUSING AND DECISION SUPPORT: Introduction to Decision Support, OLAP: Multidimensional Data Model, Multidimensional Aggregation Queries, Finding AnswersQuickly, Data Warehousing, Views and Decision Support, View Materialization. **DATA MINING:** Introduction to Data Mining, Counting Co-occurrences, Mining for Rules,Tree-Structured Rules, Clustering, Similarity Search over Sequences, Incremental Mining andData Streams, Additional Data Mining Tasks			
Unit 5	**Parallel and Distributed Databases**	**8 Hours**	4
Introduction, Architectures for Parallel Databases, Parallel Query Evaluation, ParallelizingIndividual Operations, Parallel Query Optimization, Introduction to Distributed Databases,Distributed DBMS Architectures, Storing Data in a Distributed DBMS, Distributed Catalog Management, Distributed Query Processing, Updating Distributed Data, Distributed Transactions,Distributed Concurrency Control, Distributed Recovery.			
Unit 6	**Database Security**	**6 Hours**	9
Introduction to Database Security Issues, Discretionary Access Control Based on Granting andRevoking Privileges, Mandatory Access Control and Role-Based Access Control for MultilevelSecurity, SQL Injection, Privacy Issues, and Preservation, Challenges of Database Security, OracleLabel-Based Security			

Text Books:

1. Oracle® PL/SQL™ by Example FOURTH EDITION BENJAMIN ROSENZWEIG ELENA SILVESTROVA RAKHIMOV(Unit : 1)
2. Database Management System - Raghu Ramakrishnan, Johannes Gehrke - MGH, [4e] (Units: 2,4,5)
3. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education(Unit-3)
4. Fundamentals of Database Systems -R. Elmasri S. B. Navathe - Addison Wesley-SixthEdition(Unit-6)

Reference Books:

1. Database System Concepts - Silberschatz, Korth, Sudarshan - MGH, 6th Edition
2. Data Mining - Margaret H. Dunham - Pearson Education
3. NoSQL Distilled: A brief guide to merging world of Polyglot persistence - Pramod J. Sadalage and Marin Fowler - Addison Wesley
4. Database Systems, Design, Implementation and Management - Coronel-Morris- Rob - Cengage Learning, [9e]

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Code:	23CSEU7P02
Course Name:	Advanced Database Systems Lab

L	T	P	Credit
0	0	2	1

Course Prerequsites:

Set Theory, Fundamental of Software Engineering (SDLC)

Course Description:

The course develops hands-on skills in PL/SQL programming, database programming, Oracle database features, NoSQL databases, data warehousing, database security, object-relational concepts, and SQL operations through structured laboratory assessments and real-world applications.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamentals of database management systems	4
CO2	Analyze & construct good database design	9
CO3	Apply SQL queries to design & manage the database	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1		3	1	1			1	1	1		
CO2	1	3	2	3	2	3	1	3	1	1	3	2		
CO3	2	3	2	2	3	3	1	3	1	1	3	2		
CO4														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal	50%	Practical performance, Submission, Internal POE
2	External	50%	POE



Course Contents:		SDGs
Assessment No. 1 : Write a simple PL/SQL Program for the following i. Print the sum of "N" numbers ii. Check whether the input number is prime or not.	4 Hours	4,9
Assessment No. 2 : Implement & Demonstrate Declaring, Defining, and Invoking a Simple PL/SQL Function for the below statement. i. Find the Factorial of the number.	4 Hours	4,9
Assessment No. 3 : Implement a PL/SQL Procedure for the following i. Find a Maximum of three numbers using "IN" & "OUT" Parameters ii. Find the square of the Number using the "IN OUT" Parameter	2 Hours	4,9
Assessment No. 4 : Using Oracle Sequence demonstrate creating and dropping of an auto-number field for Customer Table.	2 Hours	9,4
Assessment No. 5 : Demonstrate NoSQL Key-Value Database.	2 Hours	9,4
Assessment No. 6 : Demonstrate No SQL Document Database.	2 Hours	9,4
Assessment No. 7 : Demonstrate Data Control Language Commands	2 Hours	9
Assessment No. 8 : Construct star schema. Demonstrate Fact and dimension tables	2 Hours	8
Assessment No. 9 : Examine SQL Injections.	4 Hours	9
Assessment No. 10 : Demonstrate Object-oriented& Object Relational databases.	2 Hours	4

Text Book:

1. Oracle® PL/SQL™ by Example FOURTH EDITION BENJAMIN ROSENZWEIG ELENA SILVESTROVA RAKHIMOV(Unit : 1)
2. Database Management System - Raghu Ramakrishnan, Johannes Gehrke - MGH, [4e] (Units: 2,4,5)
3. NoSQL for Mere Mortals- Dan Sullivan- 1st Edition, Pearson Education(Unit-3)
4. Fundamentals of Database Systems -R. Elmasri S. B. Navathe - Addison Wesley-SixthEdition(Unit-6)

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Code:	23CSEU7P03	L	T	P	Credit
Course Name:	Software Testing and Quality Assurance	1		2	2

Course Prerequsites:

Software Engineering, Object Oriented Modeling and Design

Course Description:

This course covers basic concepts, techniques, and tools used in Software Testing and Quality Assurance with emphasis on theory and hands-on practice. The syllabus is aligned with industry practices, focusing on verification, validation, test design, automation, metrics, and quality models. All laboratory work uses open-source tools only.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand fundamentals of software testing, quality, and verification models.	4,9
CO2	Design effective test cases, test plans, and test documentation.	4,9
CO3	Apply software metrics and quality models for process and product evaluation.	9,12
CO4	Experience hands-on practice with open-source testing and automation tools.	4,9,17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1		2			1		3	2	2	1	
CO2	1	2	2	1	3			1		2	3	1	3	1
CO3	1	1	1	1	3						1	1	3	
CO4	1	1	1	2	3			1		2	1	2	3	1

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Assessment	50%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	POE	50%	Practical/Oral Examination

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Contents:			SDGs
Unit 1	**Introduction to Software Testing and QA**	**3 Hours**	
Software failures and lessons learned, Role of testing in software development, Testing process and terminology, Principles and limitations of testing, Software Quality concepts, Verification vs Validation, V-Model and Agile testing overview.			4,9
Unit 2	**Software Verification and Test Design**	**4 Hours**	
Verification methods and reviews, SRS and design document verification, Code and user documentation reviews, Software project audits, Use case diagrams and scenarios, Test case design from SRS and use cases, Boundary value analysis, equivalence partitioning, Database testing basics			4,9
Unit 3	**Regression and Object-Oriented Testing**	**4 Hours**	
Regression testing concepts, Test case selection and prioritization, Risk-based testing, Code coverage techniques, Object-oriented testing principles, Class testing, state-based testing, interaction and path testing.			9
Unit 4	**Software Metrics and Measurement**	**4 Hours**	
Web application architecture overview, Functional and UI testing, Usability and accessibility testing, Compatibility and configuration testing, Security and performance testing basics, Automated test data generation approaches, Overview of open-source automation frameworks.			9,10,17

List of Experiments:		SDGs
1	**Software Verification** – Review and verification of SRS and design documents using checklists.	4,9
2	**Use Case Modeling** – Creation of use case diagrams and scenarios for a given system.	4,9
3	**Test Case Design** – Designing test cases from SRS and use cases.	4,9
4	**Test Plan Preparation** – Preparing a complete test plan for a given application.	8,9
5	**Manual Testing** – Functional and regression testing of a sample application.	9,12
6	**Object-Oriented Testing** – Class and interaction testing for an OO-based system.	4,9
7	**Unit Testing with Open-Source Frameworks** – JUnit/TestNG based unit testing.	9,17
8	**Automation Testing (UI)** – Web UI automation using Selenium.	8,9
9	**API Testing** – REST API testing using Postman or similar open-source tools.	9,17
10	**Performance Testing** – Load and stress testing using Apache JMeter.	9,12
11	**Test Data Generation and Reporting** – Automated test data generation and test report preparation.	4,9

Text Books:

1. Yogesh Singh, Software Testing, Cambridge University Press, First Edition.
2. Norman Fenton and Shari Lawrence Pfleeger, Software Metrics: A Rigorous and Practical Approach, 2nd Edition, Thomson Press.

Reference Books:

1. Foundations of Software testing: Aditya P. Mathur, Pearson, Second Edition
2. Software Testing: Ron Patton, Pearson (SAMS), Second Edition
3. Software Metrics – A Rigorous & Practical approach: Norman Fenton, Shari Lawrence Pfleeger, 2nd Edition (Thomson Press)

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	23CSEU7M04
Course Name:	API Testing

L	T	P	Credit
2			2

Course Prerequsites:

Basic programming knowledge in Java or any object-oriented programming language.
Familiarity with HTTP, JSON, and XML formats.

Course Description:

This course introduces the fundamentals and modern techniques of Natural Language Processing (NLP). It covers text preprocessing, language modeling, text classification, sentiment analysis, vector semantics, embeddings, sequence labeling, and lexical resources. Students will gain hands-on experience with popular NLP tools and explore recent trends such as transformer-based models and real-world applications like question answering and chatbots.

Course Outcomes:	After the completion of the course the student will be able to -	SDG
CO1	Understand API fundamentals, client-server architecture, REST and GraphQL concepts.	4,9
CO2	Design, execute, and automate data driven API test cases using Postman.	4,8,9
CO3	Make use of Apache JMeter for API performance and load testing and analyze performance metrics.	4,8,9
CO4	Develop data-driven REST API testing frameworks using REST Assured.	4,8,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1					1		1		
CO2	2	3	3	2	3				1	2		2	2	1
CO3	2	3	2	3	3				1	1		2	3	3
CO4	3	3	3	2	3				1	2		2	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE)	100%	100% course contents

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Course Contents:

Unit 1	**Introduction to API testing**	**7 Hours**	**SDG**
Introduction to api basics, client-server architecture model & 3 tier architecture model, HTTP methods, Evolution of APIs, classification of APIs , Introduction to GraphQL, GraphQL Basics and Comparison with REST			4,9
Unit 2	**API Testing Using Postman**	**7 Hours**	
Introduction to Postman and Its Importance, Creating and Organizing Collections, Environment and Global Variables, GET, POST, PUT, DELETE, HEAD, OPTIONS Requests with Examples, Post script and Pre script, Request Chaining, Assertions and Response Validations, Running Collections with Collection Runner and Newman CLI, Query Parameters, Form Parameters, Path Parameters, Schema Validations, Collection Runner and Data driven automation testing, Newman Reports and Postman CLI Reports, Integrating Postman Collections in CI/CD Pipelines, GraphQL testing using Postman			4,8,9
Unit 3	**Introduction to Jmeter**	**7 Hours**	
Jmeter Introduction & Jmeter core concepts, JMeter's Recording, JMeter's Properties Files, JMeter Plugin Manager & Plugins Installation & Uninstallation, Jmeter Test Execution, Performance testing, Load testing using Jmeter			4,8,9
Unit 4	**REST API Testing with Rest Assured**	**7 Hours**	
REST vs SOAP Overview, Adding REST Assured Dependencies in Maven, Setting up Base URI and Base Path, Request and Response Specification Builders, Passing Headers, Path Params, Query Params, Validating Status Codes and Response Body, Authentication: Basic Auth, Bearer Token, OAuth 2.0, Using POJOs for Payloads (Serialization & Deserialization), Data-Driven API Testing with TestNG and Excel/CSV/JSON			4,8,9

Text Books:

API Testing and Development with Postman — Dave Westerveld
REST API Testing Cookbook — Sudhakar Gummadi
Performance Testing with JMeter — Bayo Erinle
Rest-Assured API Testing — Bas Dijkstra
API Testing with Java — Rajkumar G

Reference Books:

Testing Web APIs — Mark Winteringham
Apache JMeter Practical Guide — Emily Hoder
Master Apache JMeter — Jayant Varma
The Complete Guide to Performance Testing with JMeter — Neeraj Kumar
Automated REST API Testing with Java — Alan Richardson
Java for Testers — Alan Richardson

E Resources :

https://www.guru99.com/postman-tutorial.html
https://www.youtube.com/@AutomationStepbyStep
https://www.youtube.com/@postman
https://www.youtube.com/@RahulShettyAcademy
https://www.youtube.com/@naveenautomationlabs



Course Code:	23CSEU7E05
Course Name:	Cyber Security

L	T	P	Credit
3			3

Course Prerequsites:

1. C, C++, Python or Java
2.Understanding of OS concepts (Linux/Windows)
3. Networking Basics
4. Data Structures and Algorithms concepts

Course Description:

This course introduces core concepts of cyber security and digital forensics, covering network protection, threat analysis, legal frameworks, and evidence handling. Students gain practical skills in forensic tools and security measures to counter modern cyber threats.

Course Outcomes:	After the completion of the course the student will be able to -	SDG
CO1	Identify and describe cyber threats and vulnerabilities	9,16
CO2	Apply network security principles and tools to secure communication systems	9
CO3	Demonstrate knowledge of cyber forensic techniques and tools	16
CO4	Analyze digital evidence in accordance with legal and ethical frameworks	16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1		3	1	2	3	1	3	1
CO2	2	2	1	1	2	1		3	1	2	3	2	3	1
CO3	2	2	2	2	2	1		3	1	2	3	1	3	1
CO4	2	1	1	2	3	1		3	1	2	3	1	3	1
CO5														

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			
Unit 1	**Introduction to Cyber Security**	**8 Hours**	**SDG**
1.1 Fundamentals of Cyber Security 1.2 Security frameworks: NIST, ISO27001 and Types of cyber attacks (Phishing, DoS, Ransomware, MITRE Attack etc.) 1.3 Cyber threats and vulnerabilities 1.4 Information Security goals: CIA triad (Confidentiality, Integrity, Availability) 1.5 Security mechanisms and access control models 1.6 Basics of cryptography (Symmetric vs Asymmetric, Hashing, Digital Signatures)			9,16
Unit 2	**Network Security**	**8 Hours**	
2.1 SIEM basics:QRadar, splunk and Incident Response Life Cycle 2.2 Network Security basics: Protocols(TCP/IP, DNS, HTTP) Ports 2.3 Network threats and attacks (Sniffing, Spoofing, MITM, ARP poisoning) 2.4 Firewalls, Firewall rules and types (packet-filtering, proxy, stateful) 2.5 Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS) 2.6 Virtual Private Networks (VPNs) 2.7 Secure socket layer (SSL), HTTPS, EDR Basics 2.8 Wireless network security protocols (WEP, WPA, WPA2)			9
Unit 3	**Cyber Forensics Fundamentals**	**7 Hours**	
3.1 Introduction to Cyber Forensics 3.2 Need for cyber forensics in investigation 3.3 Forensic investigation process (Acquisition, Analysis, Reporting) 3.4 Chain of custody 3.5 Legal and ethical issues in cyber forensics 3.6 Tools used in cyber forensics (FTK, EnCase, Autopsy)			16
Unit 4	**Digital Evidence and Crime Scene Management**	**6 Hours**	
4.1 Types of digital evidence (emails, logs, images, etc.) 4.2 Digital evidence collection and preservation 4.3 Imaging and cloning of digital media 4.4 Evidence handling procedures and documentation 4.5 Investigating disk, memory, mobile, and network-based evidence 4.6 Challenges in digital evidence handling			16
Unit 5	**Cyber Laws and IT Act**	**6 Hours**	
5.1 Overview of Indian IT Act 2000 and amendments 5.2 Legal aspects of digital signatures, electronic records 5.3 Cybercrime and related sections under IPC and IT Act 5.4 Intellectual Property Rights (IPR) in cyberspace 5.5 Cyber ethics and legal frameworks 5.6 Case studies on cybercrime			4,16
Unit 6	**Emerging Trends and Case Studies**	**6 Hours**	
6.1 Cybersecurity in IoT and cloud computing 6.2 Blockchain and security 6.3 Artificial Intelligence in cybersecurity 6.4 Case studies on recent cyber attacks and forensic investigations 6.5 Role of CERT-IN, NCIIPC, and global agencies 6.6 Best practices for securing digital assets			9,16



Text Books:

1. Behrouz A. Forouzan – Cryptography and Network Security, McGraw-Hill.
2. John Sammons – The Basics of Digital Forensics, Syngress/Elsevier
3. Nina Godbole & Sunit Belpure – Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India.

Reference Books:

1. Nelson, B., Phillips, A., & Steuart, C. –Guide to Computer Forensics and Investigations, Cengage Learning.
2. William Stallings – Cryptography and Network Security, Pearson Education.
3. Marjie T. Britz – Computer Forensics and Cyber Crime, Pearson Education.
4. Chuck Easttom – Computer Security Fundamentals, Pearson Education.



Course Code:	23CSEU7E06
Course Name:	Artificial Neural Networks

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Linear Algebra, Probability & Statistics, Python Programming

Course Description:

This course introduces students to the theory and design of artificial neural networks, covering key architectures such as feedforward, convolutional, and recurrent networks. It emphasizes learning algorithms, optimization techniques, and real-world applications in areas like image and text processing. Students will also explore advanced models and ethical considerations in AI.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand and explain the architecture, components, and learning mechanisms of various neural network models including feedforward, convolutional, and recurrent networks.	4, 9
CO2	Apply appropriate learning algorithms and optimization techniques to train and evaluate neural networks for classification and prediction tasks.	4, 9
CO3	Analyze the performance of neural network models using metrics and tuning methods, and address issues like overfitting and vanishing gradients.	4, 9
CO4	Explore advanced neural architectures such as autoencoders and GANs, and assess their applications and ethical implications in real-world scenarios.	4, 10, 16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											2	
CO2		1		1	1									2
CO3		1		1	1						1			1
CO4						2							2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			SDGs
Unit 1	**Introduction to Neural Networks**	**6 Hours**	
Biological vs Artificial Neurons, McCulloch-Pitts Model, Perceptron and Linearly Separable Problems, Activation Functions: Sigmoid, Tanh, ReLU, Softmax, Learning Rules: Hebbian, Delta, Perceptron Learning			4, 9
Unit 2	**Multilayer Perceptrons and Back Propagation**	**7 Hours**	
Architecture of MLP, Forward and Backward Propagation, Gradient Descent and its Variants (SGD, Momentum, Adam), Loss Functions: MSE, Cross-Entropy, Overfitting and Regularization (L1, L2)			4, 9
Unit 3	**Deep Neural Networks**	**8 Hours**	
Deep Learning Concepts and Architectures, Vanishing/Exploding Gradient Problem, Batch Normalization, Dropout, Hyperparameter Tuning and Model Evaluation, Introduction to TensorFlow and PyTorch			4, 9
Unit 4	**Convolutional Neural Networks**	**7 Hours**	
Convolution Operation and Filters, Pooling Techniques (Max, Average), CNN Architectures: LeNet, AlexNet, VGG, ResNet, Applications in Image Classification and Object Detection			9
Unit 5	**Recurrent Neural Networks**	**7 Hours**	
RNN Architecture and Training, Vanishing Gradient Problem in RNNs, LSTM and GRU Networks, Applications in NLP: Text Classification, Sentiment Analysis, Time Series Forecasting			9
Unit 6	**Advanced Topics and Applications**	**7 Hours**	
Autoencoders: Sparse, Denoising, Variational, Generative Adversarial Networks (GANs): Architecture and Training, Transfer Learning and Fine-Tuning, Introduction to Transformers, Ethical AI: Bias, Fairness, and Societal Impact			9, 10, 16

Text Books:

1. Haykin, S., Neural Networks and Learning Machines, Pearson Education.
2. Goodfellow, I., Bengio, Y., Courville, A., Deep Learning, MIT Press.
3. Nielsen, M., Neural Networks and Deep Learning, Determination Press.

Reference Books:

1. Kumar, S., Neural Networks: A Classroom Approach, McGraw Hill Education.
2. Aggarwal, C. C., Neural Networks and Deep Learning: A Textbook, Springer.
3. Chollet, F., Deep Learning with Python, Manning Publications.
4. Rashid, T., Make Your Own Neural Network, CreateSpace Independent Publishing.



Course Code:	23CSEU7E07
Course Name:	Mobile Technology

L	T	P	Credit
3			3

Course Prerequsites:

Data Communication & Networking, TCP/IP Protocol Suite

Course Description:

Mobile Technology subject mainly deals with the science of mobile communication. It covers layered approach of mobile communication covering layers such as – data link, network and transport layer. It also introduces the 5G technology.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the basic physical and technical functioning of mobile communications systems.	4,9
CO2	Describe the basic principles of mobile communication system and summarize the working of network and transport layer in the context of mobility.	4,9
CO3	Compare principles of the modern mobile and wireless communication systems such as 5G with 3G/4G.	9,11
CO4	Illustrate the principles and applications of wireless systems and standards.	4,9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	1	2			1									
CO3	1	3		3	1								2	
CO4	1		2		1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Introduction**	**7 Hours**	9
Introduction to Wireless Networks, Applications, History, Simplified Reference Model, Wireless transmission, Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular Systems: Frequency Management and Channel Assignment, Types of handoff and their characteristics.			
Unit 2	**Medium Access Control (MAC) & GSM Telecommunication System**	**7 Hours**	9
MAC, Motivation, SDMA, FDMA, TDMA, CDMA, Telecommunication Systems, GSM: Architecture, Location tracking and call setup, Mobility management, Handover, Security, GSM SMS, International roaming for GSM, call recording functions, subscriber and service data management.			
Unit 3	**Mobile Network Layer:**	**7 Hours**	9
IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.			
Unit 4	**Mobile Transport Layer**	**7 Hours**	9
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective retransmission, Transaction Oriented TCP.			
Unit 5	**Mobile Ad hoc Networks (MANETs)**	**7 Hours**	9,11
Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery.			
Unit 6	**5G Mobile Network – Future of Mobile Communication**	**7 Hours**	9,11
10 Pillars of 5G, concept of small cell, Cognitive radio -overview, spectrum optimization literature, key requirements and challenges for 5G cognitive terminal. Wireless spectrum white spaces – Background, TV white space technology, white space spectrum opportunities and challenges.			

Text Books:

1. Jochen Schiller, \Mobile Communication", Pearson Education.
2. Theodore & S. Rappaport, \Wireless Communications, Principles, Practice", PHI.
3. William Stallings, \Wireless Communications and Networks", Pearson Education.
4. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, First Edition 2015 John Wiley & Sons, Ltd Publication

Reference Books:

1. Wireless telecommunications systems and networks / Gary J. Mullett. Cengage Publication.



Course Code:	23CSEU7E08
Course Name:	Business Intelligence and Analysis

L	T	P	Credit
3			3

Course Prerequsites:

Basic knowledge of programming, database management systems, data structures, and introductory statistics is required. Familiarity with data analysis concepts and SQL will be beneficial.

Course Description:

This course provides an overview of Business Intelligence concepts and analytical techniques used for data-driven decision making. It covers data warehousing, data mining, visualization, performance management, text analytics, web analytics, and social analytics.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Define basic concepts ,Architecture and data warehousing related concepts of Business Intelligence	4, 9
CO2	Demonstrate the impact of business reporting, information visualization, and dashboards.	8, 9, 12
CO3	Apply text analytics and web analytics business intelligence methods to various situations.	9, 16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2				2	3	3	3	3	3
CO2	2	3	2	3	2	3		3	3	3	3	3	3	3
CO3	1	3	2	3	2	3		3	3	3	3	3	3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Introduction to Business Intelligence**	**8 Hours**	
Introduction to Business Intelligence (BI), Need for Business Intelligence in Organizations, Framework for Business Intelligence (BI), Architecture of Business Intelligence Systems (Data sources, Data integration layer, Data warehouse, Analytics and reporting layer) Benefits and Business Value of BI, Role of BI in Decision Making (Strategic, Tactical, Operational), Comparison of Business Intelligence with Competitive Intelligence and Knowledge Management, Applications of BI in different domains (Finance, Marketing, Healthcare, Retail overview)			8,9
Unit 2	**Data warehousing**	**7 Hours**	
Introduction to Data Warehousing, Characteristics of Data Warehousing, Data Marts and their Types, Data Warehousing Process, Data Warehousing Architectures(Single-tier, Two-tier, and Three-tier architectures), Data Integration, Extraction Transformation and Load (ETL) Process, OLAP versus OLTP, Data Warehousing Implementation Issues, Real-Time Data Warehousing			9
Unit 3	**Business Reporting, Visual Analytics and Business Performance Management**	**6 Hours**	
Introduction to Business Reporting, Data and Information Visualization, Types of Charts and Graphs, Emergence of Data Visualization and Visual Analytics, Performance Dashboards, Balanced Scorecard, Dashboards versus Scorecards, Six Sigma as a Performance Measurement System			8, 9, 12
Unit 4	**Data mining – Supervised and unsupervised learning**	**8 Hours**	
Introduction to Data Mining, Data Mining Concepts and Applications, Data Mining Process, Data Mining Methods, Supervised Learning Techniques, Unsupervised Learning Techniques, Association Rule Mining, Data Mining Software Tools, Case Studies, OLAP and ETL Tools: Case Studies			4, 9
Unit 5	**Text Analytics, Text Mining and Sentiment Analysis**	**7 Hours**	
Introduction to Text Analytics and Text Mining, Text Analytics and Text Mining: Concepts and Definitions,Text Mining Process, Text Mining Tools, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process			9, 16
Unit 6	**Web Analytics, Web Mining, and Social Analytics**	**6 Hours**	
Introduction to Web Mining, Web Mining Overview, Web Content Mining and Web Structure Mining, Search Engines, Search Engine Optimization (SEO), Web Usage Mining, Web Analytics Maturity Model, Web Analytics Tools, Social Analytics, Social Network Analysis			9, 16

Text Books:

Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics, Pearson 10th edition, 2018 .

Reference Books:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial
Perspective, 4th Edition, Pearson, 2017
2. "Business Intelligence For Dummies" by Swain Scheps.



Course Code:	23CSEU7E09
Course Name:	Computer Vision

L	T	P	Credit
3	0	0	3

Course Prerequsites:

Computer graphics, Data structures

Course Description:

This course on Computer Vision introduces students to the fundamental principles, techniques, and applications of computer vision. Through hands-on experience, students will learn how to process, analyze, and interpret visual data from the world around us. The course covers topics such as image preprocessing, feature extraction, object detection, deep learning for computer vision, and advanced topics like generative models and autonomous systems. Students will also work with popular computer vision frameworks and libraries such as OpenCV, TensorFlow, and Keras

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Define computer vision and image processing and explain the basics of image representation
CO2	Apply edge detection techniques and image segmentation methods
CO3	Examine the principles of neural networks and deep learning and apply CNNs for image classification
CO4	Develop image analysis using the Google Cloud Vision API

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	SDGs
CO1	3	2	1	1	2				1	2	2	1	3	3	4,9
CO2	3	3	2	3	3				2	2	2	2	3	3	9,3
CO3	3	3	3	2	3	2	1	1	2	2	2	2	3	3	9,4
CO4	3	2	2	3	2	2	1		2	2	3	2	3	3	9,8

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation1 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination [30 Marks]	30%	50% Course Contents
3	In Semester Evaluation2 [10 Marks]	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination [50 Marks]	50%	100% Course Contents

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Course Contents:			SDGs
Unit 1	**Introduction to Computer Vision and Image Processing**	**7 Hours**	4,9
Overview of Computer Vision, Image representation and formats, Basic image transformations (scaling, rotation, flipping),Image enhancement and filtering techniques, Color space conversions and histogram equalization, Introduction to OpenCV			
Unit 2	**Detection and Extraction**	**7 Hours**	9,3
Keypoint detection and matching (SIFT, SURF, ORB),Edge detection techniques (Sobel, Canny, Laplacian),Image segmentation (Thresholding, Region Growing),Histogram of Oriented Gradients (HOG),Feature extraction using deep learning			
Unit 3	**Object Detection and Recognition**	**7 Hours**	9,11
Object detection vs. image classification ,Haar Cascades and Viola-Jones Algorithm for face detection ,Convolutional Neural Networks (CNN) for image classification ,R-CNN, Fast R-CNN, Faster R-CNN for object detection ,YOLO (You Only Look Once) for real-time object detection ,SSD (Single Shot Multibox Detector)			
Unit 4	**Deep Learning for Computer Vision**	**7 Hours**	9,4
Introduction to neural networks and deep learning ,Training CNNs for image classification ,Transfer learning and pre-trained models (VGG, ResNet, Inception),Data augmentation techniques ,Generative Adversarial Networks (GANs) for image generation			
Unit 5	**Visual Intelligence**	**7 Hours**	11,3
Image captioning using CNN and RNN ,Semantic segmentation using models like U-Net and FCN, 3D computer vision: Stereo vision, depth sensors ,Face recognition using deep learning (FaceNet, OpenFace) ,Object tracking techniques: Optical flow, Kalman filters, and Deep SORT ,Computer vision in autonomous systems (Self-driving cars)			
Unit 6	**Cloud-based Computer Vision Solutions**	**7 Hours**	9,17
Google Cloud Vision API for image analysis ,Training custom models using Google Cloud AutoML Vision ,Cloud-based deployment and scaling using Google Cloud AI Platform, Real-time inference and monitoring using Google Cloud			

Text Books:

1.“Programming Computer Vision with Python: Tools and algorithms for analyzing images”- Jan Erik Solem
2.“Learning OpenCV 4: Computer Vision with Python” by Adrian Kaehler and Gary Bradski
3.“Computer Vision: Algorithms and Applications” (2nd Edition)- Richard Szeliski

Reference Books:

1. “Hands-On Computer Vision with TensorFlow 2" by Benjamin Planche and Eliot Andres
2.“Cloud AI Services with Google Cloud: Building Smart Applications with Vision, Language, and Conversation AI”- Gunjan Aggarwal



Course Code:	23CSEU7E10
Course Name:	Natural Language Processing

L	T	P	Credit
3			3

Course Prerequsites:

Basic Python programming skills, Fundamentals of probability and statistics, Introductory machine learning concepts

Course Description:

This course introduces the fundamentals and modern techniques of Natural Language Processing (NLP). It covers text preprocessing, language modeling, text classification, sentiment analysis, vector semantics, embeddings, sequence labeling, and lexical resources. Students will gain hands-on experience with popular NLP tools and explore recent trends such as transformer-based models and real-world applications like question answering and chatbots.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the core concepts and challenges in natural language processing.	4
CO2	Apply language modeling, text preprocessing, and classification techniques to text data.	4, 9
CO3	Implement NLP applications using standard tools and resources.	9
CO4	Analyze recent trends and resources in NLP for real-world applications.	9, 10

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	2	1			2								2	1
CO3	1	2	2	2	3								3	3
CO4		3	2	3	3								3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:

Unit 1	**Introduction**	**6 Hours**	**SDGs**
Origins and challenges of NLP, Levels of NLP (morphology, syntax, semantics, pragmatics), Ambiguity and language complexities, Text normalization, Regular expressions, Corpora, Applications of NLP in real-world systems			4, 9
Unit 2	**Language Modelling & Text Preprocessing**	**9 Hours**	
N-gram models (unigram, bigram, trigram), Evaluating language models (perplexity, entropy), Smoothing techniques (Laplace, Kneser-Ney), Minimum Edit Distance (MED), Spelling correction, Stop-word removal, Stemming, Lemmatization, Introduction to NLP tools (NLTK, spaCy)			9
Unit 3	**Text Classification & Sentiment Analysis**	**7 Hours**	
Naive Bayes classifier for text classification, Sentiment analysis approaches (rule-based VADER, statistical), Feature representation (Bag-of-Words, TF-IDF), Evaluation metrics (Precision, Recall, F1-score), Ethical considerations in classification			9, 11
Unit 4	**Vector Semantics & Embeddings**	**7 Hours**	
Lexical semantics and word similarity, Vector space models (TF-IDF, PMI), Word embeddings (Word2Vec basics), Applications of embeddings in NLP tasks, Bias in embeddings and mitigation strategies			5, 10
Unit 5	**Sequence Labeling & Named Entity Recognition**	**7 Hours**	
English word classes, Part-of-Speech tagging (rule-based, HMM), Named Entity Recognition (NER) basics, Conditional Random Fields (CRFs) for sequence labeling, Evaluation of tagging and NER systems, Hands-on with spaCy for POS and NER			9
Unit 6	**Lexical Resources & Recent Trends**	**7 Hours**	
WordNet (synsets, synonyms, antonyms, word senses), Word Sense Disambiguation (WSD) techniques, Lexical resources (Treebank, PropBank, Indian WordNet), Recent trends in NLP (transformers overview: BERT, GPT), Applications (Question answering, chatbots)			9, 10, 11

Text Books:

1. “Natural language processing and Information Retrieval” Tanveer Siddiqui, U.S. Tiwary, Oxford
2. “Speech and Language Processing” Daniel Jurafsky and James H Martin 2E, Pearson Education

Reference Books:

1. “Natural language Understanding”, James Allen 2e, Pearson Education
2. “Natural language processing”: a Paninian perspective, Bharati A., Sangat R., Chaitanya V.. PHI

D.Y. PATIL EDUCATION SOCIETY Kasba Bawada, Kolhapur KOLHAPUR

Course Code:	23CSEU7R11
Course Name:	Research Methodology

L	T	P	Credit
4			4

Course Prerequsites:

Fundamental knowledge of statistics and mathematics.
Basic English communication and academic writing skills.
Analytical thinking and problem-solving ability.

Course Description:

This course introduces the fundamentals of research methodology, including research design, data collection, sampling, statistical analysis, hypothesis testing, report writing, and research ethics. It also covers citation methods, reference management tools, and the use of software such as SPSS, R, and Python for research. The course prepares students to conduct and communicate ethical, systematic, and high-quality research in engineering and technology.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Understand the meaning, objectives, types of research, research process, and formulate research problems	4, 9
CO2	Apply various sampling techniques, data collection methods, and analyze research data using appropriate statistical techniques and tests of significance.	4, 9
CO3	Prepare research reports, thesis writing, research proposals, and communicate research findings effectively through presentations.	4, 9, 17
CO4	Apply research ethics, understand plagiarism issues, and follow proper citation and referencing methods in academic writing.	4, 16

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	1	1					1	1	1		
CO2	1	2		3	3						2	2	3	
CO3	1				1	3			2	3	3	1		
CO4	1		2		1			3		2		2	1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents



Course Contents:			SDGs
Unit 1	**Introduction to Research and Research Problem**	**8 Hours**	
Meaning of Research, Objectives of Research, Motivation in Research, Types of Research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Methods vs. Methodology. Research Process - Steps involved in research process. Criteria of Good Research. Problems Encountered by Researchers in India. Defining the Research Problem - Selecting the problem, Necessity of defining the problem, Technique involved in defining a problem.			4, 9
Unit 2	**Research Design**	**8 Hours**	
Meaning of Research Design, Need for Research Design, Features of a Good Design. Important Concepts Relating to Research Design - Dependent and Independent Variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Experimental and Non-Experimental Hypothesis-testing Research. Different Research Designs - Research design in case of exploratory research studies, Descriptive and Diagnostic research studies, Hypothesis-testing research studies. Basic Principles of Experimental Designs - Principle of Replication, Principle of Randomization, Principle of Local Control. Important Experimental Designs - Informal Experimental Designs, Formal Experimental Designs (Completely Randomized Design, Randomized Block Design, Latin Square Design, Factorial Designs)			4, 9
Unit 3	**Sampling and Data Collection**	**6 Hours**	
Census and Sample Survey. Implications of a Sample Design. Steps in Sampling Design. Criteria of Selecting a Sampling Procedure. Characteristics of a Good Sample Design. Different Types of Sample Designs - Probability Sampling (Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Area Sampling, Multi-stage Sampling) and Non-probability Sampling (Deliberate Sampling, Convenience Sampling, Quota Sampling). Methods of Data Collection - Primary Data - Observation Method, Interview Method, Collection through Questionnaires, Collection through Schedules. Secondary Data - Sources of secondary data, Precautions in using secondary data. Selection of Appropriate Method for Data Collection.			4, 16
Unit 4	**Processing and Analysis of Data**	**8 Hours**	
Processing Operations - Editing, Coding, Classification, Tabulation. Statistics in Research - Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Quartile Deviation, Mean Deviation, Standard Deviation). Measures of Asymmetry (Skewness). Measures of Relationship (Correlation - Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation). Regression Analysis - Simple Linear Regression, Multiple Regression. Testing of Hypotheses - Basic Concepts concerning Testing of Hypotheses (Null Hypothesis and Alternative Hypothesis, Level of Significance, Decision Rule, Type I and Type II Errors). Flow Chart for Hypothesis Testing Procedure. Important Parametric Tests - z-test, t-test, F-test (ANOVA). Chi-square Test as a Non-parametric Test. Computer Software Packages for Data Analysis - SPSS, R, Python basics.			4, 9
Unit 5	**Interpretation and Report Writing**	**8 Hours**	
Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation. Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report - Preliminary Pages, Main Text, End Matter. Types of Reports - Technical Report, Popular Report, Thesis/Dissertation format. Writing Research Proposal - Purpose and format of research proposal, Components (Introduction, Review of Literature, Research Methodology, Expected Results, Budget and Time Schedule). Presentation of Research Work - Oral Presentation, Poster Presentation. Mechanics of Writing a Research Report - Layout, Structure and Language of Report, Footnotes, Appendix, Bibliography and References. Precautions for Writing Research Reports.			4, 9, 17



Unit 6	Research Ethics and Citation Methods	6 Hours	
Ethics in Research - Research involving human subjects, Animal rights and research, Ethical issues in data collection and analysis, Informed consent, Privacy and confidentiality. Academic Integrity - Plagiarism (Types, Detection, Prevention), Fabrication and Falsification of data, Authorship issues. Citation and Referencing - Importance of citations, Different Citation Styles (APA Style, IEEE Style, ACM Style, Harvard Style, Chicago Style). In-text Citations and Reference List preparation. Using Reference Management Software - Mendeley, Zotero, EndNote basics. Intellectual Property Rights in Research - Copyright, Patents in Computer Science context. Publication Ethics - Duplicate publication, Predatory journals, Peer review process.			4, 16

Text Books:

1. C.R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 4th Edition (2004).
2. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for Beginners", SAGE Publications, 5th Edition (2019).

Reference Books:

1. John W. Creswell, "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches", SAGE Publications, 5th Edition.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta and Company Ltd, 2nd Edition.
3. Anol Bhattacherjee, "Social Science Research: Principles, Methods, and Practices", University of South Florida, 2nd Edition.
4. Donald H. McBurney and Theresa L. White, "Research Methods", Cengage Learning, 8th Edition.

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR
Kasba Bawada, Kolhapur

Course Code:	23CSEU7J12
Course Name:	Project

L	T	P	Credit
		8	4

Course Prerequsites:

Completion of the prescribed courses in the Major Engineering Programme and the Multidisciplinary Minor Programme.
Basic knowledge of engineering design, programming/software tools, research methodology, and project development.

Course Description:

The Capstone Project is the culminating component of the Multidisciplinary Minor Programme. It enables students to integrate knowledge acquired from their major discipline and multidisciplinary minor to solve real-world engineering, industrial, societal, or research problems.

Course Outcomes:	After the completion of the course the student will be able to -	**SDGs**
CO1	Identify and analyze a real-world engineering problem related to society, industry, and individuals.	4, 11, 17
CO2	Design and develop an innovative engineering solution as per the requirements	9, 8, 12
CO3	Implement, test, and evaluate the proposed solution considering technical, ethical, environmental, and societal aspects.	9, 12, 13, 16
CO4	Demonstrate effective teamwork, project management, technical documentation, and professional communication through successful project execution and presentation.	4, 8, 17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	1	2	1					1	1	2
CO2	2	2	3	2	3	1	1		1		2	2	2	2
CO3	2	2	3	3	3	2	2	2	1	1	1	2	2	3
CO4			1		1			2	3	3	3	2	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal POE	50%	Presentations, Demonstration
2	External POE	50%	Presentations, Demonstration

D Y PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Guidelines

Students have to form teams that consist of four to five members. Every group will have to submit their area of interest and the corresponding student details through the provided form. Next, in accordance with the selected area of interest and in consideration of the expertise of the faculty, every group will get a guide.

Topic selection and finalization process will take place at the hands of the project evaluation team. After topic selection and finalization, there will be a need for the group to move forward with the preparation and presentation of the project's synopsis inline with the standard document format provided by the Programme Evaluation Committee. The group will need to prepare an SRS document. Evaluation of SRS will be done considering many aspects such as requirement gathering, requirement analysis, teamwork and presentation.

The project selected will be implemented and tested as per the guidelines provided by the group guide. The Project Documentation/Report would be submitted at the end of the semester. The guidelines for all Documentations will be duly provided by the department at relevant time frames.



D. Y. PATIL DEEMED TO BE UNIVERSITY
SCHOOL OF ENGINEERING AND MANAGEMENT
Teaching and Evaluation Scheme from Year 2023-24 (as per NEP-2020)
B. Tech. Computer Science Engineering (SEMESTER- VIII)

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	Contact Hrs			ISE	MSE	ESE	INT	OE/ PoE	
					L	P	T						
1	23CSEU8P01	PCC $	Agentic AI	**3**	3	-	-	20	30	50	-	-	100
2	23CSEU8P02	PCC $	Agentic AI Lab	**1**	-	2	-	-	-	-	25	-	25
3	23CSEU8M03	MDM-VI $	Capstone Project	**2**	-	4	-	-	-	-	25	25	50
4	23CSEU8E04	PEC-VI $	Real Time Operating Systems	2	2	-	-	-	-	50	-	-	50
5	23CSEU8E05		Deep Learning										
6	23CSEU8E06		Digital Forensics										
7	23CSEU8I07	INT	Internship	**12**	-	24	-	-	-	-	200	200	400
			Total	**20**	**5**	**30**	**-**						**625**

Note:
$ - Open & Distance Learning
* - Values are not included in total marks
Min. Marks for Passing: 40% of total marks of individual course
#- Students opted AIML as Honors are not allowed to opt Deep Learning (PEC VI)

HONORS

Sr. No.	Course Code	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/	
1	23CSEU8Z01	Honors	Capstone Project AI/ML $	2	-	4	-	-	-	-	50	-	50
2	23CSEU8Z02	Honors	Capstone Project Cyber Security $	2	-	4	-	-	-	-	50	-	50



Course Code:	23CSEU8P01
Course Name:	AgenticAI

L	T	P	Credit
3			3

Course Prerequsites:

Data Structures, Intermediate Python Object-Oriented Programming (OOP), and Foundational Natural Language Processing (NLP).

Course Description:

A comprehensive deep-dive into the architecture of Agentic AI. Students will move from theoretical reasoning frameworks to building, fine-tuning, and evaluating autonomous agents that can use tools and interact with external environments.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the fundamental architecture of AI agents, specifically the "Think → Act → Observe" loop and the role of LLMs as reasoning engines.	4
CO2	Design and implement custom "Tools" for agents to interact with web APIs, databases, and local code environments.	4, 9
CO3	Develop multi-agent systems and agentic RAG workflows using frameworks like smolagents, LangGraph, or LlamaIndex.	9
CO4	Fine-tune models for function-calling and evaluate agent performance using modern observability and testing protocols.	9, 10

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	-	2	2	2
CO2	2	2	3	2	3	-	-	1	-	-	-	2	3	3
CO3	3	3	3	3	3	-	-	-	2	1	-	3	3	3
CO4	3	3	2	3	3	-	-	2	-	-	-	2	3	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.



4	End Semester Examination (ESE)	50%	100% course contents

Course Contents:

Unit 1	**Foundations of Agentic Intelligence & The ReAct Framework**	**6 Hours**	**SDGs**
Focus: Transitioning from static LLM prompting to dynamic, loop-based reasoning.Core Concepts:The anatomy of an Agent: Core LLM, System Prompts, Chat Templates, and Special Tokens.The Thought -- Action --Observation loop.Deep dive into the ReAct (Reason + Act) paradigm.Building custom programmatic "Tools" via Python function parsing and docstring extraction.			**4, 9**
Unit 2	**Code-Executing Agents & smolagents**	**8 Hours**	
JSON/Text Tool-calling versus Code Execution modalities. The smolagents architecture (CodeAgent vs. ToolCallingAgent). Secure runtime sandboxing and state management for dynamic code execution. Multi-step autonomous tool creation.			**9**
Unit 3	Agentic RAG & Knowledge Retrieval	**8 Hours**	
Schedulability problem, Classification of real-time tasks, Schedulability tests , Worst Case Execution Time (WCET), Static scheduling, Dynamic scheduling, Dependent and independent tasks			**9, 11**
Unit 4	Data Driven Agents and Agentic RAGs	**8 Hours**	
Static RAG versus Agentic RAG. Semantic routing, document indexing, and vector database integration. Advanced query pipelines: Sub-question decomposition and query rewriting. Data Agents: Direct SQL database querying and structured API interaction.			**5, 10**
Unit 5	Multimodal Agents, Web Automation, & SLM Optimization	**8 Hours**	
Vision-Language Models (VLMs) as agent drivers. Web Browser Automation: DOM tree parsing and element bounding boxes. Fine-tuning Small Language Models (SLMs) for strict syntax and function calling. Local agent deployment using Ollama backends.			**9**
Unit 6	**Benchmarking, Safety, & Observability**	**6 Hours**	
Evaluation frameworks: GAIA and SWE-bench benchmarks.			**9, 10, 11**

Text Books:

https://huggingface.co/agents-course
1. Generative AI Systems: Architecture and Engineering". Tom Taulli (O'Reilly Media)
2. "Building Intelligent Systems: A Guide to Machine Learning Engineering". Geoff Hulten (Apress)

Reference Books:

Supplementary Technical References
1. "Natural Language Processing with Transformers: Building Language Applications with Hugging Face". Lewis Tunstall, Leandro von Werra, and Thomas Wolf (O'Reilly Media)
2. "Designing Data-Intensive Applications" Martin Kleppmann (O'Reilly Media)



Course Code:	23CSEU8P02
Course Name:	Agentic AI Lab

L	T	P	Credit
		2	1

Course Prerequsites:

Proficiency in Python Programming (functions, object-oriented concepts, and basic error handling). Foundational understanding of Generative AI & LLMs (tokenization, prompting, API-based model consumption). Basic acquaintance with data libraries (Pandas) and databases (SQL) is helpful but not strictly required.

Course Description:

This hands-on laboratory course introduces students to the architecture, design patterns, and implementation of Agentic AI and multi-agent systems. Moving beyond static Large Language Model (LLM) prompts, students will learn to build autonomous systems capable of reasoning, planning, tool execution, and collaborative problem-solving. Utilizing industry-standard frameworks such as CrewAI, LangGraph, AG2 (AutoGen), and PydanticAI, students will design, debug, and deploy state-driven AI agents tailored for real-world domains like automated software workflows, data exploration, healthcare, and customer support.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	CO1 (Analyze & Design): Evaluate business and technical workflows to break them down into state-driven, multi-agent architectures using appropriate design patterns (sequential, routing, parallel).	4
CO2	CO2 (Implement & Orchestrate): Build and configure autonomous AI agents that successfully call external APIs, execute custom Python/SQL tools, and manage structured schema inputs safely.	4, 9
CO3	CO3 (Evaluate & Optimize): Implement self-reflection and multi-agent collaboration mechanisms to debug, critique, and optimize the quality of autonomous AI outputs.	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2	3								2	1
CO2	2	3	2	3	3								3	3
CO3	2	3	2	3	3								3	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	Internal Evaluation	100%	Assignment, Test, Quiz, Seminar, Presentation, etc.

List of Experiments:		SDGs
1	Lab 1: Fundamentals of Autonomous Reasoning & ReAct — Implement the foundational thought-action-observation loop from scratch using raw Python.	4
2	Lab 2: Precision Tool-Calling & Input Validation — Bind functional math and logic tools to an LLM with strict error-handling defenses.	4, 9
3	API Integration & Web Content Extraction — Build an agent that securely pulls, parses, and summarizes live data from external web services.	9
4	Conversational SQL & Data Exploration — Create an AI data assistant that translates natural language queries into executable SQL commands.	9
5	State Management & Routing with LangGraph — Design a graph-based agent architecture with structured state transitions and conditional routing logic.	9
6	Multi-Agent Choreography with CrewAI — Orchestrate a team of role-specific agents wrapped in a front-end UI to handle complex, multimodal tasks.	9
7	Schema-Driven Design with PydanticAI — Enforce enterprise-grade data guardrails on agent inputs and outputs using strict Pydantic data schemas.	9
8	Self-Reflective Loops & Collaborative Research — Deploy a multi-agent system featuring automated self-critique nodes to iteratively optimize output quality.	9

D Y PATIL EDUCATION SOCIETY
Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	23CSEU8E04
Course Name:	Real Time Operating Systems

L	T	P	Credit
2			2

Course Prerequsites:

Basic knowledge of Computer Organization, Programming in C, and Fundamentals of Operating Systems.

Course Description:

This course covers the fundamentals of Operating Systems with a focus on Real-Time Operating Systems, including RTOS concepts, scheduling techniques, schedulability analysis, and comparison of popular RTOS platforms for real-time system design.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	Explain the fundamentals of Operating Systems and Real-Time Operating Systems	4,9
CO2	Apply RTOS concepts such as task management, time management, inter-task communication, interrupt handling and scheduling techniques in real-time systems	4,9
CO3	Compare features of FreeRTOS, RT Linux, and commercial RTOS.	9,17

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			1					2		2	1	
CO2	2	3	2	2	2				2	2		1	1	2
CO3	1	3	2	3	3							2	1	3

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	End Semester Examination (ESE) [50 marks]	100% (50 Marks)	100% course contents

D.Y. PATIL EDUCATION SOCIETY KOLHAPUR Kasba Bawada, Kolhapur

Course Contents:			SDGs
Unit 1	**Introduction**	**6 Hours**	4,9
Introduction to Operating Systems, Real-Time Systems: definition,Structure and characteristics, Types of Real-Time Systems (Hard and Soft), Real-Time Operating System (RTOS): concept and need, General Purpose OS vs RTOS, Basic components of RTOS, Applications of RTOS			
Unit 2	**RTOS Fundamentals**	**8 Hours**	4,9
Task management, Task creation and deletion, Task states and task control ,Time management in RTOS, Inter-task communication basics, Exceptions and interrupt handling.			
Unit 3	**Introduction to real-time scheduling**	**8 Hours**	9
Schedulability problem, Classification of real-time tasks, Schedulability tests , Worst Case Execution Time (WCET), Static scheduling, Dynamic scheduling, Dependent and independent tasks			
Unit 4	**Features of FreeRTOS and Linux**	**6 Hours**	9,17
Features and application of Commercial real time operating systems: PSOS, VRTX, RT Linux			

Text Books:

1. Real-Time Concepts for Embedded Systems by Qing Li and Caroline Yao
2. Embedded Real-Time Systems: Concepts, Design & Programming by Dr. K.V.K.K. Prasad
3. Operating System Concepts by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne

Reference Books:

1. A Practical Introduction to Real-Time Operating Systems (RTOS) by Douglas Wilhelm Harder, Jeff Zarnett & Vajih Montaghami
2. Real-Time Systems: Theory and Practice by Rajib Mall
3. Real-Time Embedded Systems by Christos Koulamas & Mihai T. Lazarescu
4. Mastering the FreeRTOS Real Time Kernel by Richard Barry
5. Using the FreeRTOS Real Time Kernel: A Practical Guide by Richard Barry

D.Y. PATIL EDUCATION SOCIETY
Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	23CSEU8E05
Course Name:	Deep Learning

L	T	P	Credit
2			2

Course Prerequsites:

Python Programming and Scripting

Course Description:

This course introduces the fundamentals and advanced concepts of Deep Learning, covering machine learning basics, neural network architectures, and optimization techniques. It explores feed-forward networks, backpropagation, CNNs, RNNs, LSTMs, and GRUs for vision and sequence tasks. The course also covers generative models, autoencoders, GANs, and modern deep architectures such as ResNet and GCN, with applications in computer vision, language processing, image captioning, and video analysis.

Course Outcomes:	After the completion of the course the student will be able to -	SDGs
CO1	illustrate the basic concepts of linear algebra for Mathematical models and Deep neural network model	4,9
CO2	construct the feed forward network using gradient descent and regularization technique	9
CO3	model the Convolutional neural network and articulate the sequence modelling using Recurrent models for processing high dimensional	9
CO4	design the deep neural network to model computer vision related applications such as object detection, image captioning	9

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2									1	2		
CO2	2	2			2					1	2			
CO3	1	1	2	1	3							1		2
CO4	2	2		1	1								1	2

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

D.Y. PATIL EDUCATION SOCIETY (Deemed to be University) Kasba Bawada, Kolhapur KOLHAPUR

Course Contents:			SDGs
Unit 1	**Introduction**	**7 Hours**	
Introduction to Artificial Intelligence, Machine Learning and Deep Learning. Machine Learning Basics, Learning Algorithms, Supervised Learning and Unsupervised Learning, Linear Algebra for Machine Learning, Historical Trends in Deep Learning, Deep Learning Software Libraries, Introduction to a Simple Deep Neural Network (DNN).			4,9
Unit 2	**Data Preparation and Model Evaluation**	**8 Hours**	
Dimensionality Reduction, Overfitting and Underfitting, Cross-Validation, Hyperparameters, Training Set, Validation Set and Test Set, Estimators, Bias and Variance, Regularization Techniques. Introduction to Deep Feed Forward Networks, Shallow Neural Networks, Deep Neural Networks, Learning XOR Problem, Gradient-Based Learning, Backpropagation Algorithm, Activation Functions, Error/Loss Functions, Architecture Design, Differentiation Algorithms, Hyperparameter Tuning, Batch Normalization.			9
Unit 3	**Sequence Modeling and Autoencoders**	**8 Hours**	
Sequence Modeling, Recurrent Neural Networks (RNNs), Difficulties in Training RNNs, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Encoder–Decoder Architectures, Applications in Spam Classification and Sentiment Analysis. Autoencoders – Architecture, Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Autoencoders, Denoising Autoencoders, Contractive Autoencoders, Variational Autoencoders (VAE), Applications.			9
Unit 4	**Optimization, GANs and Deep Architectures**	**7 Hours**	
Optimization for Deep Learning, RMSProp for RNNs, SGD for CNNs, Adversarial Generative Networks (GANs), GAN Applications, Deep Architectures in Computer Vision, ImageNet and ImageNet Large Scale Visual Recognition Challenge (ILSVRC), ResNet, Graph Convolutional Networks (GCN), Applications in Image Captioning, Applications in Video Tasks			9

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press,
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Michael Nielsen, “Neural Networks and Deep Learning”, Online book, 2016
4. Jason Brownlee, “Deep Learning with Python”, 2016.
5. Aaron Courville, Ian Goodfellow, and Yoshua Bengio, “Deep Learning”, MIT Press, 2015.

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction”
2. by SethWeidman, “Deep Learning from Scratch: Building with Python from First Principles”O’Reily
3. Francois Duval, “Deep Learning for Beginners, Practical Guide with Python and Tensorflow”

D.Y. PATIL EDUCATION SOCIETY
Kasba Bawada, Kolhapur
KOLHAPUR

Course Code:	24CSEU7E06
Course Name:	Digital Forensic and Incident response

L	T	P	Credit
2			2

Course Prerequsites:

Basic knowledge of Computer Networks, Operating Systems, and Cyber Security fundamentals.

Course Description:

This course provides a comprehensive understanding of digital forensic techniques and incident response processes used to investigate cybercrimes. Students will learn evidence acquisition, preservation, analysis, and reporting along with handling real-world security incidents. The course emphasizes logal, ethical and practical aspects of Digital Forensic investigation.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Understand principles and processes of digital forensics.
CO2	Apply forensic tools and techniques for evidence acquisition and analysis.
CO3	Analyze and respond to cybersecurity incidents effectively.
CO4	Prepare forensic reports adhering to legal and ethical standards.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	**SDGs**
CO1	1	2									1	2	1		4, 8, 9,16
CO2	2	2			2					1	2				
CO3	1	1	2	1	3							1		2	
CO4	2	2		1	1								1	2	

Assessment Scheme:

SN	Assessment	Weightage	Remark
1	In Semester Evaluation 1 (ISE1)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
2	Mid Semester Examination (MSE)	30%	50% of course contents
3	In Semester Evaluation 2 (ISE2)	10%	Assignment, Test, Quiz, Seminar, Presentation, etc.
4	End Semester Examination (ESE)	50%	100% course contents

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Course Contents:			
Unit 1	**Introduction**	**6 Hours**	**SDGs**
Introduction to Digital Forensics, Need and Scope of Digital Forensics, Types of Digital Evidence, Digital Forensics			4,8,9
Unit 2	**Computer and Disk Forensics**	**8 Hours**	
File Systems (FAT, NTFS, EXT), Disk Structure, Data Acquisition Techniques, Disk Imaging and Hashing (MD5, SHA), Deleted File Recovery, Slack Space, Metadata Analysis, Introduction to Forensic Tools.			4,8,9
Unit 3	**Memory and Network Forensics**	**8 Hours**	
Volatile Memory Concepts, RAM Acquisition and Analysis, Malware Indicators in Memory, Network Forensics Overview, Packet Analysis, Network Logs, Intrusion Detection Logs, Traffic Analysis Basics.Mobile Device Forensics Overview, SIM and App Data Analysis, Cloud Forensics Challenges			4,8,16
Unit 4	**Incident Response and Handling**	**8 Hours**	
Incident Response Lifecycle (Preparation, Identification, Containment, Eradication, Recovery, Lessons Learned), Incident Classification, Roles and Responsibilities, Incident Documentation, Evidence Handling during Incidents.Types of Cyber Crimes, Malware Types (Virus, Worm, Trojan, Ransomware),			4,8,9

Text Books:

1. “Guide to Computer Forensics and Investigations” — by Bill Nelson, Amelia Phillips, and Christopher Steuart
2. “Incident Response & Computer Forensics” — by Kevin Mandia, Chris Prosise

“Incident Response & Computer Forensics” — by Kevin Mandia, Chris Prosise

Reference Books:

1. “Computer Forensics: Cybercriminals, Laws, and Evidence” — by Marie-Helen Maras
2. “Practical Forensic Imaging” — by Bruce Nikkel
3. “The Art of Memory Forensics” — by Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters

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