An Autonomous Institute

Shree Warana Vibhag Shikshan Mandal's

Tatyasaheb Kore Institute of Engineering And Technology, Warananagar

Department of Computer Science & Engineering

Third Year Bachelor of Technology (B. Tech) in Computer Science & Engineering

w.e.f. AY- 2025-26

T.Y.B.Tech. (Sem-VI) Computer Science & Engineering

Syllabus Structure and Curriculum as per NEP 2020

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Department of Computer Science & Engineering

Vision

To become center of excellence in the field of Computer Science and Engineering and develop competent IT technocrats

Mission

- To develop engineering graduates with high degree of processional excellence
- To excel in academics and research through contemporary and real world problems
- To enhance graduate employability through work based learning in social entrepreneurship
- To encourage industrial and nationally recognized institutes collaboration
- To create an environment to nurture lifelong learning

Program Educational Objectives (PEOs)

Graduates will be,

- Able to design and develop computing system using modern technologies by adapting business intelligence and challenges.
- Able to acquire capabilities with aptitude for higher education and entrepreneurship
- Able to function effectively as professionals having excellent interpersonal skills with ethical and social obligations.
- Able to work efficiently in multidisciplinary and multicultural environment
- Able to lead in their respective domain and contribute positively to the needs of society.

Program Specific Outcomes (PEOs)

Graduate will be able to

- Identify, design and develop solution for real world problems by implementing phases of software development process model
- Analyze and apply the computer science engineering solutions in societal and human context
- Demonstrate the skills and knowledge of contemporary issues in the field of Computer science and Engineering

Quality Policy

- To promote excellence in academic and training activities by inspiring students for becoming competent professionals to cater industrial and social needs.

SWVSM'S

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Abbreviations

S N	Acronym	Definition
1	ISE	In-Semester Examination
2	ESE	End-Semester Examination
3	ISA	In-Semester Assessment (Term Work)
4	L	Lecture
5	T	Tutorial
6	P	Practical
7	CH	Contact Hours
8	C	Credits

Course Bucket Terminologies

Sr. No.	Acronym	Definition
1	PCC	Professional Core Course
2	MDM	Multidisciplinary Minor
3	OE	Open Elective Course
4	HSSM	Humanities Social Science and Management
5	ELC	Experiential Learning Course
6	VSEC	Vocational and Skill Enhancement Course
7	AEC	Ability Enhancement Course

Course/ Subject Code

F.Y.B.Tech Syllabus change year	UG/PG	Course Category with number	Separator	Branch	Semester	Course Number	
23	UG	PCC	-	CSE	6	0	1

Course Term work and POE Code

CSE	3	0	1	T / P / A
Branch	Semester	Course Number		T - Term work P - POE A - Audit Course

Third Year B. Tech.

(Semester – VI)

in

Computer Science & Engineering

Curriculum Structure, Credits and Evaluation Scheme as per NEP 2020

(to be implemented from AY 2025-26)

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

Third Year B. Tech. (Computer Science and Engineering)

Semester-VI

(To be implemented from AY 2025 - 26)

Curriculum Structure, Credit and Evaluation Scheme as per NEP 2020

Sr. No.	Category	Sub Category	Course Code	Course Title	Teaching and Credit Scheme					Examination & Evaluation Scheme			
					L	T	P	C	CH	Component	Marks	Min for Passing	
1	Program Core Courses	PCC	23UGPCC-CSE601	Cloud Computing	3	--	--	3	3	ISE	40	16	40
										ESE	60	24	
2		PCC	23UGPCC-CSE 602	Machine Learning	3	--	--	3	3	ISE	40	16	40
										ESE	60	24	
3		PCC	23UGPCC-CSE603	High Performance Computing	3	--	--	2	3	ISE	40	16	40
										ESE	60	24	
4	Program Elective Course	PEC-2	23UGPEC2-CSE604-X	Program Elective – 2	3	--	--	2	3	ISE	40	16	40
										ESE	60	24	
5		PEC-3	23UGPEC3-CSE605-Y	Program Elective – 3	3	--	--	3	3	ISE	40	16	40
										ESE	60	24	
6	Multidisciplinary Courses	MDM-4	23UGMD4-CSE606	Mathematical Methods in AI and ML	2	--	--	2	2	ISA	50	20	20
7	Skill Course	VSEC	23UGVSEC-CSE607	Web Technologies-I	2**	--	4	2	6	ISA	25	10	10
										POE	50	20	20
8	Program Core Courses	PCC	23UGPCC-CSE601P	Cloud Computing	--	--	2	1	2	ISA	25	10	10
9		PCC	23UGPCC-CSE 602P	Machine Learning	--	--	2	1	2	ISA	25	10	10
										POE	50	20	20
10		PCC	23UGPCC-CSE608P	Mini Project- II	--	--	2	1	2	ISA	25	10	10
										OE	25	10	10
11	Program Elective Course	PEC-2	23UGPEC2-CSE604-XT	Program Elective – 2	--	1	--	1	1	ISA	25	10	10
					19	1	10	21	30	--	800	320	320

****Additional contact hours are provided for the courses without any credit**

Note: In theory examination there will be separate passing for ESE and ISE

SWVSM's

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

Third Year B. Tech. (Computer Science and Engineering)

Semester- VI

(To be implemented from AY 2025 - 26)

Multidisciplinary Minor (MDM), Open Elective Course (OE) & Program Elective Courses Basket

Multidisciplinary Courses Course Basket Sem -VI			
Multidisciplinary Minor (MDM) and Open Elective Course (OE)			
Category	**Sub Category**	**Course Code**	**Name of Course**
Multidisciplinary Courses	**MDM-4**	23UGMD4-CSE606	Mathematical Methods in AI and ML

Skill Courses (SC) Course Basket Sem –VI			
Vocational and Skill Enhancement Course (VSEC)			
Category	**Sub Category**	**Course Code**	**Name of Course**
Skill Courses	Vocational and Skill Enhancement Course (VSEC)	23UGVSEC-CSE607	Web Technologies-I

Program Electives Courses (PEC) Basket

PEC -2			
Category	**Sub Category**	**Course Code**	**Name of Course**
Program Elective Course	**PEC - 2**	23UGPEC2-CSE604-1	Software Testing and Quality Assurance
		23UGPEC2-CSE604-2	Blockchain and Cryptocurrency
		23UGPEC2-CSE604-3	Quantum Computing

PEC – 3			
Category	**Sub Category**	**Course Code**	**Name of Course**
Program Elective Course	**PEC - 3**	23UGPEC3CSE605-1	Semantic Web
		23UGPEC3CSE605-2	Project Management

23UGPCC CSE601 – Cloud Computing

Click for Syllabus Structure

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	3	**ESE**	**:**	60 Marks

Course Objective: The objective of this course is to	
1	To Understand the foundational concepts and historical evolution of cloud computing and related technologies.
2	To Describe the principles of parallel and distributed computing, including elements and enabling technologies.
3	To Explain virtualization technologies and their role in cloud computing.
4	To Explore advanced cloud technologies such as containers, Docker, Kubernetes, and assess cloud security and management practices.

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Describe the fundamental concepts and platforms of cloud computing, and distinguish between parallel and distributed computing	Understand
CO2	Explain virtualization techniques and their relationship to cloud computing.	Understand
CO3	Demonstrate different types of cloud services (IaaS, PaaS, SaaS) and deployment models (Public, Private, Hybrid, Community).	Apply
CO4	Use Docker, containers, and Kubernetes by applying their architectures and networking.	Apply
CO5	Analyze basic cloud security concepts and mechanisms such as PKI, IAM, and SSO using real-world case studies.	Analyze

Course Description:

This course covers the basics of cloud computing, its history, and important platforms. It explains virtualization, cloud architectures, migration, and tools like Docker and Kubernetes. It also introduces cloud security and management with real-world examples.

Prerequisites:		
	1	Computer Networks
	2	Operating System-I
	3	Information Security Course

Section – I

Unit-1	**Introduction** Definition, Historical Developments, Computing Platforms and Technologies. Building cloud computing environments, Principles of Parallel and Distributed Computing: Parallel versus Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, and Technologies for Distributed Computing.	**6 Hours**

Unit-2	**Virtualization** Characteristics, Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization	**6 Hours**
Unit-3	**Cloud Computing Architecture** Cloud Reference Model, Types of Clouds – Public, Private, Hybrid and Community cloud, Types of Services – IaaS, PaaS, SaaS, Economics of Clouds, Open Challenges, Public Clouds: Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure	**7 Hours**
Section – II		
Unit-4	**Migration into cloud and Virtual Machine Provisioning** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.	**7 Hours**
Unit-5	**Advanced Concepts: Docker, Container and Kubernetes** Introduction Containers, Difference between Virtualization and Containers, Docker and its architecture (Jain), Understanding Docker Container, Networking. Kuberentes – Introduction, Architecture.	**6 Hours**
Unit-6	**Cloud Security and Management:** Fundamental cloud security – Basic terms and concepts, Threat agents, cloud security threats, case study example. Cloud Management Mechanisms - SLA management and case study. Cloud Security Mechanisms – PKI, IAM and SSO with case studies.	**7 Hours**

Mapping of POs & COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**POS1**	**POS2**	**POS3**
CO1	3	2	--	--	2	--	--	--	--	2	--	2	3	2	--
CO2	3	2	--	--	3	--	--	--	--	--	--	2	3	2	--
CO3	3	3	2	--	3	--	--	--	--	--	2	2	3	3	--
CO4	3	2	2	--	3	--	--	--	--	--	--	2	3	3	--
CO5	3	3	2	2	3	2	--	2	--	2	2	3	3	3	2

References	
Text Books :	
1	Mastering Cloud Computing - Buyya R, Vecchiola C, Selvi S T, McGraw Hill Education (India), 2013 (Unit 1,2,3)
2	Cloud Computing - Principles and Paradigms - Buyya R, Broberg J, Goscinski A, Wiley,2011 (Unit 4)
3	A to z on Docker: A complete Hands-On Guide to Docker Container – Swapnil Jain (Unit 5)
4	Docker Cookbook - Sébastien Goasguen, O'reilly Nov. 2015 First Edition (Unit 5)
5	Cloud Computing Concepts, Technology & Architecture - Thomas Erl, Zaigham Mahmood,nand Ricardo Puttini, (Unit 6)
Reference Books :	
1	Cloud Computing Bible - Barrie Sosinsky, Wiley Publishing Inc. 2011 (Unit,6)
2	Cloud Native DevOps with Kubernetes – John Arundel and Justin Domingus (Unit 5)
SWAYAM Courses	
1	Cloud Computing (Operational Timestamp: Thursday,29-May-2025 on 3:45PM) By Prof. Soumya Kanti Ghosh | IIT Kharagpur https://onlinecourses.nptel.ac.in/noc25_cs107/preview

23UGPCC CSE602 – Machine Learning

Click for Syllabus Structure

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	3			
Tutorials	**:**	--	**ESE**	**:**	60 Marks

Course Objective: The objective of this course is to	
1	Understand basic machine learning concepts and different types of learning methods
2	Apply common supervised and unsupervised algorithms to solve practical problems.
3	Use probabilistic and statistical approaches like Bayesian learning and NLP.
4	Develop and evaluate machine learning models using Python tools and libraries.

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Summarize foundational concepts of machine learning, its types, and real-world applications including supervised learning and evaluation metrics.	Understand
CO2	Explain the working of regression and classification algorithms such as Decision Trees, k-NN, SVM, and analyze model evaluation using cross-validation.	Understand
CO3	Apply algorithms like k-Means, Hierarchical Clustering, and PCA on datasets for unsupervised learning and dimensionality reduction.	Apply
CO4	Use Bayesian learning methods including Naive Bayes and probabilistic inference along with text classification techniques such as TF-IDF and stemming.	Apply
CO5	Outline ensemble methods like Bagging, Boosting and describe the structure of recommendation systems including collaborative and content-based filtering.	Understand

Course Description :

This course introduces fundamental concepts and techniques of machine learning, including supervised and unsupervised learning, Bayesian methods, natural language processing, and recommendation systems. Students will learn to apply algorithms and evaluate models using real-world data.

Prerequisites :	**1**	Programming in Python
	2	Probability and statistics
	3	Linear algebra and matrices

Section – I

Unit-1	**Foundations of Machine Learning and Regression Models** Introduction to Machine Learning: definitions, applications, and types, Supervised Learning framework and basic terminology, Linear Regression, Logistic Regression, Evaluation metrics: accuracy, precision, recall, F1-score	**05 Hours**

Unit-2	**Classification Algorithms and Model Evaluation** Decision Trees and Random Forests, k-Nearest Neighbors (k-NN), Support Vector Machines (SVMs), Cross-validation, Overfitting, Underfitting, Bias-Variance tradeoff	**07 Hours**
Unit-3	**Bayesian Learning & Probabilistic Models** Bayes Theorem and Bayesian Learning, Naive Bayes Classifier, Maximum Likelihood (ML) and Maximum A Posteriori (MAP) Estimation, Probabilistic inference in classification	**07 Hours**
Unit-4	**Unsupervised Learning** Clustering: k-Means, Hierarchical clustering, Dimensionality Reduction: Principal Component Analysis (PCA), Association Rule Learning (Intro to Apriori)	**07 Hours**
Unit-5	**Neural Networks & Natural Language Processing (NLP)** Perceptron and Multilayer Perceptron (MLP), Backpropagation Basics of NLP: tokenization, stemming, TF-IDF, Text classification with Naive Bayes / Logistic Regression	**07 Hours**
Unit-6	**Ensemble Methods & Recommendation Systems** Ensemble Learning: Bagging, Boosting (Random Forest, AdaBoost), Introduction to Recommendation Systems, Content-based filtering, Collaborative filtering Case Studies and real-world ML applications	**06 Hours**

Mapping of POs & COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	--	--	--	--	--	2	--	--	--	--	3	--	--
CO2	3	3	--	2	--	--	--	--	--	--	--	--	3	--	2
CO3	3	3	3	2	--	--	--	--	--	--	--	--	3	3	3
CO4	3	--	3	2	--	--	--	--	--	--	--	--	3	--	3
CO5	3	3	--	--	--	--	--	--	--	--	--	--	3	--	3

References	
Text Books :	
1	Machine Learning – Tom M. Mitchell, McGraw-Hill Education, Indian Edition,
	Introduction to Machine Learning – Ethem Alpaydin, MIT Press, 4th Edition, 2020.
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron, O'Reilly Media, 3rd Edition, 2022.
Reference Books :	
1	Pattern Recognition and Machine Learning – Christopher M. Bishop, Springer, Reprint 2021 (Original 2006).
2	Understanding Machine Learning, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press
3	Python Machine Learning – Sebastian Raschka and Vahid Mirjalili, Packt Publishing, 3rd Edition, 2019.
SWAYAM Courses (Operational Timestamp: Saturday,10-May-2025 on 3:45PM)	
1	Introduction to Machine Learning By Prof. Balaraman Ravindran | IIT Madras https://onlinecourses.nptel.ac.in/noc25_cs46/preview
2	Machine Learning for Engineering and science applications By Prof. Balaji Srinivasan, Prof. Ganapathy Krishnamurthi | IIT Madras https://onlinecourses.nptel.ac.in/noc25_cs49/preview
3	Machine Learning Using Python Programming By Dr. Manjari Gupta, Dr. Manoj Kumar Mishra | Institute of Science, Banaras Hindu University https://onlinecourses.swayam2.ac.in/ini25_cs02/preview

23UGPCC-CSE603 High Performance Computing

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	2			
Tutorials	**:**	--	**ESE**	**:**	60 Marks

Course Objective : The objective of this course is to	
1	To introduce the current trends in computer architecture and programming model.
2	To understand shared memory and distributed architecture and programming.
3	To develop effective parallel programs using MPI, Pthreads and OpenMP.

Course Outcomes :

COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Comprehensive understanding of modern computer architecture and parallel computing concepts, system performance metrics, Cache memory organization and SIMD	Understand
CO2	Understand pipelining techniques and architectures, including linear pipelines, instruction pipelines, vector processors, and SIMD computer organization, to enhance processing efficiency and throughput.	Understand
CO3	Understanding principles of Distributed and shared memory programming.	Understand
CO4	Apply shared-memory parallel programming techniques using Pthreads to develop thread-safe applications with proper synchronization, addressing issues like cache coherence, false sharing, and efficient resource management..	Apply
CO5	Develop and execute parallel applications using OpenMP by applying key constructs such as variable scoping, reduction, loop scheduling, and synchronization to efficiently solve problems in shared-memory environments.	Apply

Course Description :

This course provides an in-depth study of advanced concepts in computer architecture and parallel programming. It explores the evolution of modern computer systems, emphasizing high-performance design techniques including pipelining, superscalar processing, and memory hierarchy optimization. Students will examine shared and distributed memory architectures, vector and SIMD processors, and gain hands-on experience in parallel programming using OpenMP. By the end, students will be equipped with the knowledge and skills to design, evaluate, and optimize parallel computing system.

Prerequisite	**1**	Operating System
	2	Computer Organization and Microcontroller
	3	Digital System and Microprocessor

Section – I		
Unit-1	**Theory of Parallelism**: Elements of Modern Computers, Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Vector Super Computers SIMD Super Computers, Cache Memory Organization	**5 Hours**
Unit-2	**Pipelining:** Linear Pipeline Processors, Instruction Pipeline Design, Vector Processor Principles, SIMD Computer Organization	**6 Hours**
Unit-3	**Distributed-Memory Programming with MPI** **Getting started:** Compilation and execution, MPI programs, SPMD programs, Communication, Message matching, Status argument, semantics of MPI_send and MPI_recv , Trapezoidal Rule in MPI, **Dealing with I/O:** Output, Input, **Collective Communication:** Tree-structured communication, MPI_Reduce, Collective vs. point-to-point communications, MPI_Allreduce, Broadcast, Data distributions, MPI Derived Datatypes, **Performance Evaluation of MPI Programs:** Taking timings, Results, Speedup and efficiency, Scalability .	**7 Hours**
Section – II		
Unit-4	**Shared-Memory Programming with Pthreads** Processes, Threads, and Pthreads, Hello World, Matrix-Vector Multiplication, Critical Sections, Busy-Waiting, Mutexes,	**6 Hours**
Unit 5	**Synchronization and Cache Coherence in Shared-Memory Programming** Producer consumer synchronization and semaphores, Barriers and Condition Variables, Read-Write Locks, Caches, Cache coherence and False sharing, Thread safety	**6 Hours**
Unit-6	**Shared-Memory Programming with OpenMP** Getting Started: Compiling and running OpenMP programs, The program, Error Checking, The Trapezoidal Rule , Scope of variables, The reduction clause ,The parallel for Directive, More about loops in OpenMP , Scheduling Loops, Producer and consumers	**6 Hours**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	--	--	--	--	--	--	--	--	2	--	1	--
CO2	3	2	3	2	--	1	--	--	1	1	1	2	--	1	--
CO3	3	2	2	1	2	--	--	--	1	--	--	2	--	1	--
CO4	3	2	2	2	--	--	--	--	--	--	--	1	--	2	2
CO5	2	2	2	2	--	--	--	--	--	--	--	1	--	2	2

References	
Text Books :	
1	An Introduction to Parallel Programming by Peter S. Pacheco, Elsevier, 2011.
2	Advanced Computer Architecture By Kai hwang and Nares Jotwani , McGraw Hill
Reference Books :	
1.	Parallel computing theory and practice by Michel J. Quinn by TMH
2.	Computer Architecture & Parallel Processing by Kai Hwang & Briggs, McGraw Hill.
3.	Parallel and Distributed Systems by Arun Kulkarni, Napur Prasad Giri, Wiley Publications, 2nd Edition
SWAYAM Courses	
1.	NPTEL Course on High Performance Computing for Scientists and Engineers (Operational Timestamp: Thursday,29-May-2025 on 10:39 AM) https://nptel.ac.in/courses/112105293
2	Introduction to parallel programming with OpenMP and MPI (Operational Timestamp: Thursday,29-May-2025 on 10:42 AM) https://onlinecourses.nptel.ac.in/noc23_cs28/preview

23UGPEC2-CSE604-1-Software Testing and Quality Assurance

Click for Syllabus Structure

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	2	**ESE**	**:**	60 Marks
Tutorials	**:**	1	**ISA**	**:**	25 Marks

Course Objective: The objective of this course is	
1	Understand software testing processes and quality assurance methods as a fundamental component of the software life cycle.
2	Apply testing activities to create test cases from SRS and Use cases.
3	Analyze different Software Testing Activities
4	Compare testing tools on different website application

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Understand the testing life cycle model.	Understand
CO2	Apply various methods to prepare test cases.	Apply
CO3	Perform software testing activities for different types of Requirements as per the Use Cases.	Evaluate
CO4	Compute test coverage and yield according to a variety of criteria by applying software testing methods	Analyze
CO5	Prepare Testing plan for web-based application using automation testing tool.	Create

Course Description:		
This course is designed to understand the fundamentals of software testing concepts		
Prerequisites:	**1**	Concepts of Software Engineering.
	2	Application of Data Structures in unit testing.
	3	Exposure OOPS concepts for creating classes with their functionalities.

Section – I		
Unit-1	**Introduction to Testing** Software Failures, Testing Process, Terminologies, Limitations of Testing, The V Shaped software life cycle model.	**05 Hours**
Unit-2	**SRS and Use cases** Verification Methods, SRS document verification, SDD document verification, Source code reviews, User documentation verification, Software project audit **Creating test cases from SRS and Use cases:** Use Case Diagram and Use Cases, Generation of test cases from use cases, Guidelines for generating validity checks, strategies for data validity, Database testing.	**05 Hours**

Unit-3	**Regression Testing** Regression testing, Regression Test cases selection, Reducing the number of test cases, Risk analysis, Code coverage prioritization techniques.	**05 Hours**
Section – II		
Unit-4	**Software Testing Activities** Levels of Testing, Debugging, Software Testing Tools, Dynamic Software Testing Tools, Process Management Tools. **Object oriented testing:** What is Object orientation. What is object-oriented testing? Path testing, State based testing, Class testing.	**05 Hours**
Unit-5	**Testing Web applications** Web testing, Functional testing, UI testing, Usability testing, configurations and compatibility testing, security testing, performance testing, database testing, post deployment testing, web metrics.	**06 Hours**
Unit-6	**Software Testing Tools** Automated Test Data Generation Approaches to test data generation, Test data generation tools. Types of Automation Testing Tools- Load Runner, Java Selenium – Advantages of Automation, Architecture, Locators, WebDriver Methods, Web Element Methods, ListBox, parameterization, Screenshot, Action Classes.	**06 Hours**

Mapping of POs & COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	--	--	--	--	--	--	--	2	--	--	1	--	1
CO2	3	3	--	--	2	--	--	--	--	2	--	--	2	2	1
CO3	3	2	2	--	2	--	--	--	--	2	--	--	2	--	2
CO4	3	3	2	3	3	--	--	--	--	2	--	--	2	2	2
CO5	3	3	3	2	3	--	--	--	--	2	2	--	3	2	2

References	
Text Books:	
1	Software Testing: Yogesh Singh, Cambridge University Press, First Edition (Unit-I,II,III,VI)
2	Effective Methods for Software Testing, William E. Perry, Third Edition, Wiley India, 2009 (Unit –IV, V)
3	Software Testing – Principles and Practices Naresh Chauhan, Oxford University Press, 2010 (Unit –IV)
Reference Books:	
1	Foundations of Software testing: Aditya P. Mathur, Pearson, Second Edition
2	Software Testing: Ron Patton, Pearson (SAMS), Second Edition
3	Software Quality, Mordechai Ben Menachem, Garry S. Marliss, BS Publications
SWAYAM Courses (Operational Timestamp: Saturday,27-May-2023 on 3:45PM)	
1	NPTEL Course on Software Testing By Prof. Rajib Mall | IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_cs47

Term Work & Tutorial List	
1	What is software testing? What are its needs and limitations in the software development process?
2	Apply different verification techniques on a sample SRS and FRS document. List which techniques suit which SDLC phase.
3	Create a use case diagram for a university management system.
4	Apply boundary value analysis and equivalence class partitioning to validate input fields in a login form.
5	Write SQL queries to perform backend database testing for a student management system.
6	Select appropriate regression testing techniques to reduce redundant test cases from a test suite.
7	Generate test cases based on object-oriented principles for a given class diagram.
8	Evaluate the performance of a sample web-based application using different software testing methods.
9	Prepare and execute test cases for a sample web application using LoadRunner.
10	Perform white-box testing on a given piece of code and identify all possible control flow paths.
11	Design test cases using decision table–based testing for an online payment gateway scenario.

23UGPEC2-CSE604-2 - Blockchain and Cryptocurrency

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	3	**ESE**	**:**	60 Marks
Tutorials	**:**	1	**ISA**	**:**	25 Marks

Course Objective: The objective of this course is to	
1	Understand the foundational concepts and evolution of blockchain technology
2	Analyze various blockchain types and consensus mechanisms
3	Explore the ecosystem of cryptocurrencies and smart contracts
4	Apply blockchain tools and platforms to develop, deploy, and secure smart contracts

Course Outcomes:		
Cos	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Define and explain the key concepts of blockchain technology, including its origin, structure, and components.	Understand
CO2	Demonstrate the working of cryptocurrency systems like Bitcoin and Ethereum, and their role in digital finance.	Apply
CO3	Differentiate and classify types of blockchain and consensus mechanisms based on their characteristics and use cases.	Analyze
CO4	Evaluate the design and execution of smart contracts and Initial Coin Offerings (ICOs) in various industries.	Evaluate
CO5	Design a basic blockchain application with a focus on security, scalability, and industry-specific usage.	Create

Course Description:

This course introduces the fundamentals of blockchain technology, including its architecture, consensus mechanisms, cryptocurrencies, and smart contracts. It also covers blockchain security, ICOs, and real-world applications in sectors like finance, education, and IoT, preparing students to design and evaluate blockchain-based solutions.

Prerequisites:		
	1	Basic Programming Knowledge
	2	Fundamentals of Computer Networks and Distributed Systems
	3	Basics of Cryptography and Information Security

Section – I

Unit-1	**Fundamentals of Blockchain** Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.	**5 Hours**
Unit-2	**Blockchain Types and Consensus Mechanism** Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.	**5 Hours**
Unit-3	**Cryptocurrency – Bitcoin, Altcoin and Token** Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types	**5 Hours**

	of Cryptocurrencies, Cryptocurrency Usage.	
Section – II		
Unit-4	**Public Blockchain System and Smart Contracts** **Public Blockchain System:**Introduction to Public Blockchain Systems, Public Blockchain, Blockchain Layers, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain **Smart Contracts**: Introduction to Smart Contracts, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry	**7 Hours**
Unit-5	**Initial Coin Offering (ICO)** Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms	**7 Hours**
Unit-6	**Blockchain Security and Applications** **Blockchain Security:** Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp) **Blockchain Applications:** Introduction, Blockchain in Banking and Finance, Blockchain in Education, The Blockchain and IoT	**7 Hours**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	--	--	--	--	--	--	--	1	--	--	3	-	--
CO2	2	3	2	--	2	--	--	--	--	1	--	--	3	2	--
CO3	3	3	--	--	--	--	--	--	--	--	--	--	2	--	--
CO4	2	3	3	2	3	1	--	--	1	2	--	--	2	2	3
CO5	3	2	3	2	3	--	--	--	1	2	--	1	3	3	3

References	
Text Books :	
1	Blockchain Technology By Chandramouli Subramanian, Asha George, Abhilash K A and Meena Karthikeyan , Universities Press Publication

Reference Books :	
1	Blockchain Blueprint for a New Economy, By Melanie Swan,O'Reilly Publication
2	Blockchain For Dummies By Tiana Laurence, Wiley Publication

Term Work & Tutorial	
1	Blockchain Basics by IBM using Demos and Ledgers Tutorial Link : https://developer.ibm.com/
2	Build a Blockchain in Python and Flask Tutorial Link: freeCodeCamp YouTube https://www.youtube.com/watch?v=Z1RJmh_OqeA
3	Learn Smart Contracts and Solidity in Ethereum with CryptoZombies Tutorial Link: CryptoZombies https://www.youtube.com/playlist?list=PLhoH5vyxr6QoyW97O28uheczR07q9-OSl https://cryptozombies.io/en/solidity
4	Deployment of Local blockchain and Test Contracts with Truffle, Ganache, Remix IDE Tutorial Link: Dapp University Video https://www.youtube.com/c/DappUniversity
5	Write, test, and deploy smart contracts for Ethereum with Remix IDE and MetaMask Tutorial Link: https://remix-ide.readthedocs.io/en/latest/create_deploy.html https://docs.metamask.io/wallet/concepts/smart-contracts/
6	Launch Your Own Token using TokenMint and MetaMask Tutorial Link: https://www.youtube.com/watch?v=gc7e90MHvl8 https://solana.com/docs/tokens/basics/create-mint
7	Consensus Mechanisms with Ethereum PoW and BFT Simulators Tutorial Link: https://medium.com/@abhishekranjandev/a-beginners-guide-to-consensus-algorithms-148f68452a6a https://www.imf.org/-/media/Files/Publications/FTN063/2022/English/FTNEA2022003.ashx
8	Smart Contract Security with MythX and OpenZeppelin Tutorial Link: https://mythx.io/ https://www.openzeppelin.com/
9	Hyperledger Fabric: Blockchain for Enterprises Tutorial Link: Hyperledger Docs https://hyperledger-fabric.readthedocs.io/en/release-2.5/
10	Real-World Blockchain Applications: Finance, education, IoT use cases

23UGPEC2-CSE604-3 – Quantum Computing

Lectures : 3 hrs/week
Credits : 3
Tutorials : 1

Evaluation Scheme:
ISE : 40 Marks
ESE : 60 Marks
ISA : 25 Marks

Course Objectives: The objective of this course is to

1. Understand the limitations of classical computing and the need for quantum computing.
2. Learn the basic principles of quantum mechanics relevant to computation.
3. Explore quantum bits, gates, circuits, and simple quantum algorithms.
4. Study the fundamentals of quantum information and cryptography.
5. Gain awareness of quantum computing hardware and real-world applications.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Explain the basic concepts and significance of quantum computing.	Understand
CO2	Describe fundamental quantum mechanical principles relevant to computation.	Understand
CO3	Apply quantum gates and circuit models to represent simple quantum algorithms.	Apply
CO4	Analyze quantum computing models and their advantages over classical models.	Analyze
CO5	Evaluate quantum error correction techniques and their role in reliable quantum computation.	Evaluate

Description

This course introduces the fundamental principles of quantum computing, including quantum mechanics concepts, quantum bits, gates, and circuits. Students will explore quantum algorithms, information theory, and error correction techniques. The course also highlights the comparison between classical and quantum computing models and provides insights into quantum hardware and real-world applications.

Prerequisites:	1:	Basic understanding of Linear Algebra and Complex Numbers.
	2:	Knowledge of Classical Computing and Algorithms.

Unit 1	**Introduction to Quantum Computing**	
	Classical computing vs. quantum computing, concept of qubits and quantum states, features of quantum computing including superposition, entanglement and interference, advantages of quantum computing in solving complex problems, real-world applications and significance in modern computer science.	**7 Hours**
Unit 2	**Basics of Quantum Mechanics**	
	Introduction to quantum mechanics with simple examples, basic linear algebra concepts such as vectors, matrices and complex numbers, quantum state representation, quantum measurement principles, postulates of quantum	**7 Hours**

	mechanics and their interpretations, operators and probability amplitudes.	
Unit 3	**Quantum Circuits and Gates**	
	Quantum logic gates: X, Y, Z, Hadamard, Phase, and CNOT, construction of simple quantum circuits using standard gates, visual representation through quantum circuit diagrams, concept of reversible computing, comparison of classical and quantum gate operations.	**7 Hours**
Unit 4	**Quantum Algorithms**	
	Introduction to key quantum algorithms and their importance, conceptual overview of quantum Fourier transform, basics of Grover's search algorithm, introduction to Shor's algorithm and its application to integer factorization, case studies demonstrating quantum speed-up.	**7 Hours**
Unit 5	**Quantum Information and Error Handling**	
	Quantum noise and sources of decoherence, basics of quantum error correction with simple examples, density matrices and Bloch sphere representation, introduction to entropy in quantum systems, challenges in building and maintaining stable quantum environments.	**7 Hours**
Unit 6	**Quantum Cryptography and Future Trends**	
	Basics of quantum communication and security, quantum key distribution (QKD) and BB84 protocol, conceptual explanation of quantum teleportation, applications in cryptography and cybersecurity, overview of emerging platforms like IBM Q and Google Sycamore, introduction to quantum cloud services.	**7 Hours**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	--	--	--	--	--	--	--	--	3	2	--
CO2	2	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO3	3	2	3	2	3	--	--	--	--	--	--	--	3	--	--
CO4	3	3	3	2	3	--	--	--	--	--	--	--	3	2	--
CO5	3	2	3	3	3	2	--	--	2	2	2	--	3	2	--

References:

Text Books	
1	Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.

Reference Books	
1	Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2	N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

SWAYAM Courses: (Operational Timestamp: Thursday,29-May-2025 on 10:39 AM)	
1	https://onlinecourses.nptel.ac.in/noc21_cs103/preview [IIT Madras, IBM Research]
2	https://onlinecourses.nptel.ac.in/noc19_cy31/preview [IIT Kanpur]
Additional Web-link:	
1	https://www.coursera.org/learn/quantum-computing-for-everyone-an-introduction [Coursera]
2	https://www.udemy.com/course/quantum-computing-with-ibm-qiskit-ultimate-masterclass/?couponCode=LEARNNOWPLANS [Udemy]

Term Work & Tutorial List	
1	**Introduction to Quantum Computing:** • What is the difference between a classical bit and a qubit? • Explain superposition with an example.
2	**Basics of Quantum Mechanics:** • State the basic postulates of quantum mechanics used in quantum computing. • Given a wave function $\psi = \frac{1}{\sqrt{2}}\|0\rangle + \frac{1}{\sqrt{2}}\|1\rangle$ calculate the probability of measuring 0 and 1.
3	**Quantum Gates and Circuits:** • What is the role of the Hadamard gate in a quantum circuit? • Draw a circuit applying Hadamard on qubit 1 and a CNOT gate between two qubits.
4	• **Grover's Algorithm:** • Explain the purpose of Grover's search algorithm. • Use Grover's algorithm to find a marked item in a list of 4 elements.
5	**Shor's Algorithm:** • Why is Shor's algorithm important in cryptography? • Explain the steps of Shor's algorithm for factoring the number 15.
6	**Quantum Error Correction:** • What are quantum noise and decoherence? • Show how a 3-qubit code can detect and correct a bit-flip error.
7	**Quantum Cryptography:** • What is the BB84 protocol? • Simulate a basic key exchange between two users using the BB84 protocol.
8	**Reversible Quantum Circuits:** • What is reversible computing in quantum circuits? • Design a quantum circuit to swap the states of two qubits.
9	**Entanglement and Teleportation:** • Explain quantum entanglement with a simple example. • Describe the process of quantum teleportation using entangled qubits.
10	**Quantum Hardware and Platforms:** • List current challenges in building quantum computers. • Write a short note on IBM Q or Google Sycamore quantum computer.

23UGPEC3-CSE605-1 – Semantic Web

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	3	**ESE**	**:**	60 Marks
Tutorials	**:**	--			

Course Objective : The objective of this course is to	
1	Understand the foundational concepts and layered architecture of the Semantic Web
2	Develop the ability to model and describe web resources
3	Gain proficiency in querying and manipulating semantic data
4	Explore the principles of ontology engineering and utilize Semantic Web tools

Course Outcomes :		
Cos	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Describe the goals, architecture, and technologies of the Semantic Web.	Understand
CO2	Apply RDF and RDFS to model and describe web resources with semantic meaning.	Apply
CO3	Analyze SPARQL queries to retrieve, filter, and manipulate data from RDF graphs.	Analyze
CO4	Evaluate the correctness and consistency of ontologies using OWL2 reasoning tools.	Evaluate
CO5	Create semantic web applications by designing ontologies and integrating tools for reasoning and data querying.	Create

Course Description :

This course introduces the principles and technologies of the Semantic Web, focusing on standards like RDF, RDFS, OWL, and SPARQL. Students will learn to model data semantically, construct and query knowledge graphs, design ontologies, and use Semantic Web tools. The course also covers ontology engineering practices and the development of semantic web applications.

Prerequisites :		
	1	Discrete Mathematical Structure
	2	Database Systems
	3	Basic knowledge of Web Technologies

Section – I

Unit-1	**Foundation of Semantic Web Technologies** Introduction, Semantic Web Technologies, A layered approach.	**4 Hours**
Unit-2	**Describing Web Resources: RDF** Introduction, RDF: Data Model, RDF Syntaxes, RDFS: Adding Semantics, RDF Schema: The Language, RDF and RDF Schema in RDF, An Axiomatic Semantics for RDF and RDF Schema.	**7 Hours**
Unit-3	**Querying the Semantic Web** SPARQL Infrastructure, Basics: Matching Patterns, Filters, Constructs for Dealing with an Open World, Organizing Result Sets, Other Forms of SPARQL Queries, Querying Schemas, Adding Information with SPARQL.	**7 Hours**

	Update, The Follow Your Nose Principle	
Section – II		
Unit-4	**Web Ontology Language: OWL2** Introduction, Requirements for Ontology Languages, Compatibility of OWL2 with RDF/RDFS, The OWL Language, OWL2 Profiles.	**7 Hours**
Unit-5	**Ontology Engineering** Introduction, Constructing Ontologies Manually, Reusing Existing Ontologies, Semiautomatic Ontology Acquisition, Ontology Mapping, Exposing Relational Databases, Semantic Web Application Architecture.	**7 Hours**
Unit-6	**Semantic Web Software Tools** Introduction, Metadata and Ontology Editors, Reasoners, Other Tools.	**7 Hours**

Mapping of POs & COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	--	--	--	--	--	--	--	1	--	--	3	--	--
CO2	2	3	2	--	2	--	--	--	--	1	--	--	3	2	--
CO3	2	3	2	2	--	--	--	--	--	--	--	--	3	--	--
CO4	2	2	3	2	2	--	--	--	1	--	--	--	3	3	--
CO5	3	2	3	3	3	--	--	--	2	2	--	1	3	3	3

References	
Text Books :	
1	A Semantic Web Primer, Third Edition by Grigoris Antoniou, Paul Groth, Frank Van Harmelen, Rinke Hoekstra, MIT Press
2	Semantic Web: Concepts, technologies and applications by Karin Breitman, Marco Antonio Casanova, Walt Truszkowski, Springer
Reference Books :	
1	Semantic Web: Concepts, Technologies and Applications by Karin K. Breitman, Springer India
2	Semantic Web: Semantics for Data and Services on the Web by Kashyap, Bussler, Moran, Springer India
3	Semantic Web Explained by Peter Szeredi, Gergely Lukacsy, Tamas Benko, Cambridge University Press

23UGPEC3-CSE605-2 (PCC) - Project Management

Click for Syllabus Structure

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	3 Hrs/Week	**ISE**	**:**	40 Marks
Credits	**:**	3	**ESE**	**:**	60 Marks
Tutorials	**:**	--			

Course Objective: The objective of this course is to	
1	Provide students with a basic understanding of project management principles and practices.
2	To demonstrate competency in the creation and management of a project plan.
3	Understand the impact of Scope, Time and Cost management.
4	Define strategies to calculate risk factors involved in IT projects.

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Understand the projects with organization's strategic plans, documenting the business needs and justifications for the project	Understand
CO2	Map the project management knowledge areas, processes, lifecycle phases and the embodied concepts, tools and techniques.	Understand
CO3	Use and manage the overall scope, time, cost and quality of the project, documenting project goals, deliverables, constraints, performance criteria and resource requirements	Apply
CO4	Determine project control procedures in human resource management, change management, and risk management plans	Apply
CO5	Develop, implement, and analyze Scrum, Agile Manifesto and principles.	Apply

Course Description:		
Project management focuses on the effective planning, coordination, and use of organizational resources to successfully complete specific tasks, projects, or objectives.		
Prerequisites:	**1**	Software Engineering, Testing Methodologies.

Section – I		
Unit-1	**Introduction** Project and Project Management (PM), Role of project Manager, System view of PM, Organization, Stakeholders, Project phases and lifecycle, Context of IT projects, process groups, mapping groups to Knowledge areas.	**06 Hours**
Unit-2	**Project Integration Management:** Strategic planning and project selection, developing a Project Management Plan, Directing and Managing Project Work, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases.	**06 Hours**

Unit-3	**Project Scope, Time and Cost management:** Planning Scope Management, Collecting Requirements, Defining Scope, Creating the Work Breakdown Structure, Validating Scope, Controlling Scope Planning Schedule Management, Defining Activities, Sequencing and Estimating Activity, Resources & Duration, Developing & Controlling Schedule Basic Principles of Cost Management, Planning Cost Management, Estimating Costs, Determining the Budget, Controlling Costs.	**06 Hours**
Section – II		
Unit-4	**Quality and Human Resource Management:** Importance, Planning Quality Management, Performing Quality Assurance, Controlling Quality, Tools and Techniques for Quality Control, Human Resource management: Importance, keys to managing people, human resource planning, acquiring, developing and managing project team.	**06 Hours**
Unit-5	**Risk management:** Importance, risk management planning, sources of risk, risk identification, qualitative and quantitative risk analysis, risk response planning, risk monitoring and control.	**06 Hours**
Unit-6	**Agile Project Management:** The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects	**06 Hours**

Mapping of POs & COs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	--	--	--	--	--	--	--	--	--	--	1	--	1
CO2	3	3	--	--	--	--	--	--	--	--	--	--	2	2	1
CO3	3	2	2	--	--	--	--	--	--	--	--	--	2	--	2
CO4	3	3	2	--	--	--	--	--	--	--	--	--	2	2	2
CO5	3	3	3	2	--	--	--	--	--	--	--	--	3	2	2

References	
Text Books :	
1	Information Technology Project Management, Kathy Schwalbe, Cengage Learning 7E(For Units1 to 5)
2	Software Project Management, Bob Huges, Mike Cotterell, Rajib Mall, McGraw Hill Edu (For Unit 6)
Reference Books :	
1	Effective Project Management, Robert K.Wysocki, Wiley India 7 Edition
2	Project Management Core Textbook, Mantel Jr., Meredith, Shafer, Sutton, Gopalan, Wiley India Edition
3	IT Project Management, IT Project Management, McGraw Hill Edu
SWAYAM Courses (Operational Timestamp: Saturday,10-May-2025 on 3:45PM)	
1	Project Management By Prof. Raghu Nandan Sengupta | IIT Kanpur https://onlinecourses.nptel.ac.in/noc25_mg71/preview

23UGMDM4-CSE606 – Mathematical Methods in AI and ML

Lectures : 2 Hrs/week
Credits : 2
Tutorial : --

Evaluation Scheme:
ISA : 50 Marks

Course Objectives: The objective of this course is to

1. Introduce fundamental data concepts, including data objects, attributes, and statistical measures.
2. Explain data preparation techniques such as cleaning, normalization, and transformation.
3. Explore basic probability and information theory concepts applied in ML.
4. Describe model evaluation methods including precision, recall, and ROC curves.
5. Illustrate real-world applications of ML concepts through case studies and examples.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Explain basic data concepts and statistical measures.	Understand
CO2	Describe data cleaning and normalization steps.	Understand
CO3	Apply basic probability and information theory to data problems.	Apply
CO4	Apply simple metrics to evaluate model outputs.	Apply
CO5	Identify AI/ML use cases in real-world scenarios.	Understand

Description

This course introduces fundamental mathematical models and concepts used in Machine Learning, focusing on practical understanding and real-world applications. Emphasizing intuitive learning and conceptual clarity with minimal programming, it is designed to suit students from multidisciplinary backgrounds. Topics include data analysis, probability, model evaluation, regression, classification, clustering, and dimensionality reduction, enabling effective application of AI/ML methods across various fields.

Prerequisites:	1:	Basic knowledge of mathematics
	2:	Familiarity with programming fundamentals
	3:	Understanding of basic data structures

Section – I		
Unit 1	**Understanding Data**	
	Introduction to data objects and attributes, types of data such as categorical and numerical, basic statistical concepts including mean, median, and mode, importance of data visualization, tools and examples for visualizing data.	**5Hrs**

Unit 2	**Preparing Data for Analysis and Visualization**	
	Concepts of data cleaning and handling missing values, normalization and standardization, basics of data transformation techniques, introduction to commonly used data visualization tools for analysis and communication.	**6Hrs**
Unit 3	**Basic Probability and Information Theory**	
	Fundamentals of probability, conditional probability, Bayes' Theorem with simple examples, concept of entropy and information gain, introduction to Naïve Bayes classification with applications in spam detection and document classification.	**6Hrs**
Section - II		
Unit 4	**Evaluating Models**	
	Understanding confusion matrix terms such as true positive, false positive, true negative, false negative, performance evaluation metrics including accuracy, precision, recall, F1-score, introduction to ROC curves and area under the curve (AUC).	**6Hrs**
Unit 5	**Regression and Classification**	
	Basic idea of supervised learning, concepts of linear regression with examples, overview of classification methods including logistic regression and decision trees, differences between regression and classification tasks.	**5Hrs**
Unit 6	**Clustering, Dimensionality Reduction, and Advanced Applications**	
	Introduction to unsupervised learning, clustering techniques such as K-Means with visualization, concept of centroids and clusters, basics of dimensionality reduction techniques like PCA, overview of high-dimensional data modeling, introduction to graph mining with basic use-cases, understanding outlier and anomaly detection, real-life applications in fraud detection and recommendation systems.	**7Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	3	-	2	2	-	-	-	1	1	-	2	-	3	2
CO4	2	3	-	3	2	-	-	-	-	1	-	2	-	2	2
CO5	2	-	-	-	3	2	2	2	1	1	1	3	-	3	3

References:

Text Books

1	Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, 4th Edition, 2020.

Reference Books	
1	Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.
2	Jiawei Han, Micheline Kamber, and Jian Pei, *Data Mining: Concepts and Techniques*, Morgan Kaufmann, 3rd Edition, 2011.

SWAYAM Courses:	
1	https://onlinecourses.nptel.ac.in/noc24_ma61/preview [IIT Kharagpur]
2	https://onlinecourses.nptel.ac.in/noc23_ma31/preview [IIT Kharagpur]
Additional Web-link:	
1	https://www.coursera.org/learn/machine-learning [Coursera]
2	https://www.udemy.com/course/machinelearning/?couponCode=24T7MT260525G3 [Udemy]

23UGVSEC-CSE607 – Web Technology

Click for Syllabus Structure

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	2 Hrs/Week	**ISA**	**:**	50 Marks
Credits	**:**	2			
Practicals	**:**	4	**POE**	**:**	50 Marks

Course Objective: The objective of this course is to	
1	Learn Basic web technologies and learn building blocks of a website using HTML, CSS and JavaScript
2	Learn The core concepts of HTML5, Advanced JavaScript, JQuery and AJAX through simple hands-on exercise.
3	Introduce The industry trending MERN (MongoDB, ExpressJS, ReactJS and NodeJS) stack and build an UI of the application using React JS..
4	Understand The binding of an UI to the MongoDB through NodeJS.
5	Develop Web application using PHP and MySQL

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Infer basic web technologies like HTML, CSS and JavaScript	Understand
CO2	Achieve richer user experience by implementing HTML5 features and Asynchronous communication through JQuery..	Apply
CO3	Describe industry standard applications using MERN stack layers (MongoDB, ExpressJS, ReactJS, NodeJS) and apply the features of React JS for a rich User Interface.	Understand
CO4	Integrate the UI with MongoDB database through NodeJS.	Apply
CO5	Create Web applications using Php and MySql	Create

Course Description :

This course introduces students to cutting-edge web technologies in both frontend and backend development. It emphasizes modern practices, tools, and frameworks that are currently used in the tech industry, including ReactJS, NodeJS and ExpressJS and MongoDB also php and mysql

Prerequisites :	**1**	C
	2	OOPS Concepts
	3	Basic networking concepts

Section – I

Unit-1	**Front End Web Designing HTML and CSS** HTML Design Patterns: HTML Structure, XHTML, DOCTYPE, Header Elements, Conditional Style Sheet, Structural Block Elements, Terminal Block Elements, Multipurpose Block Elements, Inline Elements, Class and ID Attributes, HTML Whitespaces CSS Selector and Inheritance: Type, Class, and ID Selector, Position and Group Selectors, Attribute Selectors, Pseudo-element Selectors, Pseudo-class Selectors, Subclass Selector,	**04 Hours**

	Inheritance, Visual Inheritance, and Bootstrap	
Unit-2	**JavaScript Basics and JQuery**	
	Introduction to JavaScript, a Basic program of JavaScript, variables, functions, conditions, loops and repetition, Functions, Event handling In JavaScript, Validating HTML form data using JavaScript, JQuery Introduction, Callbacks and Promises, Single Page Application, Asynchronous Communication	**04 Hours**
Unit-3	**ReactJS**	
	MERN Introduction, React installation and application setup with web pack, JSX, React Classes and Components, Rendering of elements, Properties, State, Context, Component lifecycle methods, Refs & Keys, Event Handling, React Router, Stateless components, React form & controls.	**04 Hours**
Unit-4	**MongoDB and NodeJS**	
	Understanding Node JS Architecture, NPM Installation and Features, Set up Node JS app, HTTP Methods and Verbs, query string, call backs , buffers, streams, File system, MongoDB-Documents, Collections, Reading and Writing to MongoDB, MongoDB NodeJS Driver, Running a React application on NodeJS.	**05 Hours**
Unit-5	**ExpressJS**	
	Introduction to Web services and REST API's , Express Installation and Server setup, Building the application stack, Routing, List API, Create API, Error Handling, Express Middleware, Express Scaffolding and Templates.	**04 Hours**
Unit-6	**PHP and MySQL Basics**	
	Outputting Data to the Browser, Data Types, Identifiers, Variables, Constants, Expressions, String Interpolation, and Control Structures Functions: Creating and Invoking function Array: Creating an array, outputting an Array, Merging, slicing, splicing, and Dissecting Arrays, and Other useful Array Functions. Sessions, Cookies and Interacting with the Database, Executing Database queries.	**05 Hours**

Proposed List of Experiments

Expt. No.	**Experiment Title**	**Bloom's Taxonomy**
1	Create a Personal Portfolio Webpage using HTML & CSS3	Apply
2	Design a User Registration Form with Form Validation using JavaScript	Design
3	Develop an Interactive Image Gallery using DOM and JavaScript	Create
4	Build a Weather App using HTML5 Geolocation API and Fetch (AJAX)	Create

5	Create a Single Page Application using jQuery and AJAX	Create
6	React App Setup and Component Rendering using JSX	Design
7	Build a React Form with State and Props	Design
8	Implement React Routing with Multiple Views (React Router)	Design and Create
9	Create a Node.js Application to Serve Static HTML Files	Create
10	Connect Node.js Application to MongoDB and Perform CRUD Operations	Apply
11	Build RESTful APIs using ExpressJS (List and Create APIs)	Apply
12	Develop a Full-Stack MERN Application: Todo App or Blog System	Create
13	Write a program to create and handle a session in PHP	Apply
14	Write a program to manage session in PHP having login facility in any web application	Create

Mapping of POs & COs:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If Applicable		
													PSO1	PSO2	PSO3
CO1	3	2	--	--	--	--	--	--	--	--	--	--	2	-	2
CO2	3	2	--	--	--	--	--	--	--	--	--	--	2	2	2
CO3	3	3	2	2	3	--	--	--	--	--	--	--	2	2	2
CO4	2	2	--	--	2	--	--	--	--	--	--	--	2	-	2
CO5	2	2	--	--	2	--	--	--	--	--	--	--	2	2	-

References	
Text Books :	
1	Pro HTML5 and CSS3 Design Patterns by Michael Bowers, Dionysios Synodinos and Victor Sumner, Apress edition
	"Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", by Vasan Subramanian. March 2017, Apress
2	Beginning PHP and MySQL: From Novice to Professional by W. Jason Gilmore Fourth Edition
Reference Books :	
1	"Beginning Node.js, Express & MongoDB Development" ,Greg Lim, July 2019
2	"Learning React, Functional Web Development with React and Redux", Alex Banks and Eve Porcello, O'Reilly Media, May 2017.
SWAYAM Courses (Operational Timestamp: Saturday,10-May-2025 on 3:45PM)	
1	Modern Application Development - Course (nptel.ac.in) By Prof. Aamod Sane, Prof. Abhijat Vichare, Prof. Madhavan Mukund | Persistent Computing Institute, Persistent Computing

	Institute, Chennai Mathematical Institute https://onlinecourses.nptel.ac.in/noc20_cs52/preview

23UGPCC CSE601P –Cloud Computing

Teaching Scheme

Practical : 2 Hrs/Week

Credits : 1

Evaluation Scheme

ISA : 25 Marks

Expt. No.	Title of Experiment	Bloom's Taxonomy
1	Study and demonstrate basic cloud computing platforms (AWS/GCP/Azure).	Understand
2	Compare parallel and distributed computing with a simple simulation.	Analyze
3	Install and configure a Virtual Box or VMware instance to demonstrate virtualization.	Apply
4	Demonstrate IaaS, PaaS, and SaaS using AWS/GCP free-tier services.	Apply
5	Create and deploy a virtual machine on a public cloud (AWS or Azure).	Apply
6	Perform Docker installation and create a simple containerized application.	Apply
7	Deploy a multi-container application using Docker Compose.	Apply
8	Set up a Kubernetes cluster using Minikube and deploy an application.	Apply
9	Simulate a basic cloud migration process using a 7-step model.	Understand
10	Demonstrate IAM and basic PKI setup on AWS with user roles and permissions.	Analyze

23UGPCC CSE602P – Machine Learning Lab

Teaching Scheme			Evaluation Scheme		
Practical	**:**	2 Hrs/Week	**ISA**	**:**	25 Marks
Credits	**:**	1	**POE**	**:**	25 Marks

Expt. No.	Experiment Name	Bloom's Taxonomy
1	Introduction to Python ML Libraries (NumPy, Pandas, Sklearn)	Understand
2	Data Visualization using Matplotlib and Seaborn	Apply
3	Basic Data Cleaning and Preparation	Apply
4	Linear Regression Implementation	Apply
5	Logistic Regression for Binary Classification	Apply
6	Decision Tree and Random Forest Classifiers	Apply
7	k-Means Clustering on Unlabeled Data	Apply
8	Naive Bayes Classification (Bayesian Learning)	Apply
9	Text Preprocessing using NLTK or spaCy	Apply
10	Building a Simple Text Classifier (e.g., Spam Detection)	Apply
11	Creating a Recommendation System using Collaborative Filtering	Apply
12	Comparing Models Using Accuracy and Confusion Matrix	Analyze

23UGPCC CSE608P – Mini Project- II

Teaching Scheme			Evaluation Scheme		
Practical	**:**	2 Hrs/Week	**ISA**	**:**	25 Marks
Credits	**:**	1	**OE**	**:**	25 Marks

Course Objective: The objective of this course is	
1	To understand how to choose a suitable problem area for a mini project.
2	To identify project problems and gather basic requirements
3	To introduce students to basic design and modeling techniques using appropriate tools and algorithms.
4	To guide students in organizing, documenting, and presenting their project work effectively

Course Outcomes:		
COs	**At the end of successful completion of the course, the students will be able to**	**Bloom's Taxonomy**
CO1	Describe how to select a relevant problem area and identify the project scope.	Understand
CO2	Demonstrate appropriate techniques to gather requirements and design data models and algorithms for the problem.	Apply
CO3	Analyze different technology options and choose the most suitable tools for module implementation.	Analyze
CO4	Apply testing strategies by designing basic test cases to validate the mini project modules.	Apply
CO5	Develop a working project by integrating modules, preparing documentation, and presenting the final output	Create

Course Description:		
This course helps students learn how to develop a mini project step by step. Students will choose a problem, gather requirements, design and build the system, and test it. Finally, they will prepare a report and present their project with conclusions.		
Prerequisites:	**1**	Data Structures
	2	Software Engineering
	3	Python
	4	Java

Activity		**Bloom's Taxonomy**
1	**Choosing your area of Mini Project Understand** Understand Students must choose the area to solve different kinds of problems.	**Understand**
2	**Problem Identification** Students must identity the problem to solve from chosen area.	**Apply**

3	**Requirement elicitation** Students must elicit the requirement for identified problem.	**Understand**
4	**Design Methodology and Modeling** Students must determine the data structures and algorithms suitable to solve identified problem and build the required models.	**Analyze**
5	**Module Implementation** Students must choose the technology and use it for implementation of functional modules.	**Create**
6	**Test Cases** Students must prepare test cases for the testing the system	**Apply**
7	**System Integrati**on Students must integrate the different functional modules to build whole system.	**Apply**
8	**Conclusion and Future Enhancement** Students must draw the conclusions and mention how system can be enhanced in future.	**Analyze**
9	**Mini Project Report Preparation** Students must integrate the different functional modules to build whole system.	**Apply**
10	**Final Presentation** Students must present their mini project work in front of panel of examiner.	**Apply**

Mapping of POs & Cos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	POS1	POS2	POS3
CO1	2	2	2	--	--	--	--	--	2	2	1	2	2	2	2
CO2	2	2	3	--	2	--	--	--	1	2	--	2	2	3	2
CO3	2	3	3	2	3	--	--	--	2	2	1	2	3	3	2
CO4	2	2	2	2	2	--	--	--	1	2	--	2	2	2	2
CO5	2	2	3	2	3	--	--	--	3	3	2	3	3	3	3

References	
Text Books :	
1	Software Engineering & Project Management by Mrs. Amita A. Jajoo and Mrs. Prajakta S. Kulkarni **Publishe**r: Nirali Prakashan
2	Software Project Management by Simy Joy, Payal Anand, Priya Nair Rajeev **Publisher**: Pearson Education.