

 SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी-ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१-२६०९०९४ ०२३१-२६०९४८७ Estd. 1962 "A++" Accredited by NAAC (2021) With CGPA 3.52	SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी-ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१-२६०९०९४ ०२३१-२६०९४८७		
--	---	---	---

Ref.No.SU/BOS/Science/259

Date: 13/07/2026.

To.

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

The Head/ Director / Co-ordinator
All Concerned Department (Science)
Shivaji University, Kolhapur.

Subject: Regarding minor change in syllabi of degree programme under the Faculty of Science and Technology.

Ref: No.SU/BOS/Science/147,148,149 &150 Date: 26/05/2026.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to minor change in syllabi, nature of question paper and equivalence etc. of degree programme under the Faculty of Science and Technology as per NEP-2020.

1.	B.Sc. Part II Microbiology (AEDP)	3.	MCA Part II
2.	B.Sc. Part III Botany	4.	M.Sc. Part II Computer Science

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

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

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

Thanking you,

Yours faithfully,



Dy Registrar

Encl: as above

for information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	7	I.T.Cell /Computer Centre
2	Director, Board of Examinations and Evaluation	8	Eligibility Section
3	Chairman, Respective Board of Studies	9	Affiliation (T.1) Section
4	B.Sc.-M.Sc. Exam Section	10	P.G. Seminar Section
5	Internal Quality Assurance Cell (IQAC Cell)	11	P. G. Admission Section
6	Appointment A & B Section	12	Affiliation (T.2) Section

SHIVAJI UNIVERSITY, KOLHAPUR



Established:1962

A⁺⁺ Accredited by NAAC (2021) with CGPA 3.52

Structure and Syllabus in Accordance with National Education Policy - 2020

With Multiple Entry and Multiple Exit

Master of Science (Computer Science)

(Under Faculty of Science and Technology)

PART-II SEMESTER - III &IV

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

1. Programme Structure

Structure in Accordance with National Education Policy - 2020

with Multiple Entry and Multiple Exit Options

M.Sc. (Computer Science) Part– II (Level-6.5)

	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment(UA)			Internal Assessment(IA)		
		Lectures+ Tutorial/ (Hours/ week)	Practical (Hours/ week)	Credit	Maximum Marks	Minimum Marks	Exam.Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-III										
Major Mandatory	MMT-301	4	--	4	60	24	2	40	16	
	MMT-302	4	--	4	60	24	2	40	16	
	MMPR-303	--	8	4	60	24	2	40	16	
	MMT-304	2	--	2	30	12	2	20	8	
	RP-307	--	8	4	60	24	--	40	16	
Major Elective	MET-305	4	--	4	60	24	2	40	16	
	MET-306									
Total				22	330			220		
Semester-IV										
Major Mandatory	MMT-401	4	--	4	60	24	2	40	16	
	MMT-402	4	--	4	60	24	2	40	16	
	MMPR-403	--	8	4	60	24	2	40	16	
	RP-406	--	8	6	90	36	--	60	24	
Major Elective	MET-404	4	--	4	60	24	2	40	16	
	MET-405									
Total				22	330			220		
Total (Sem III + Sem IV)				44						

• MMT–Major Mandatory Theory • MMPR–Major Mandatory Practical • MET–Major Elective Theory • MEPR–Major Elective Practical • RP – Research project	• Total Marks for M.Sc.-II : 1100
	• Total Credits for M.Sc.-II (Semester III &IV): 44
	• Separate passing is mandatory for University and Internal Examinations
*Evaluation scheme for OJT/FP shall be decided by concerned BoS	
• Requirement for Entry at Level 6.0:Completion of Level 5.5	
• Requirement for Exit after Level 6.0: Students can exit after completion of Level6.0 with Post Graduate Diploma in Computer Science	
• Requirement for Entry at Level 6.5: Must have completed M.Sc. Part-I (Level6.0)	

M.Sc. Semester-III		
	Major Mandatory	
MMT-301	Advanced PHP (4 credits)	MSU0325MML99I1
MMT-302	Data Science (4 credits)	MSU0325MML99I2
MMPR-303	Practical-III (4credits)	MSU0325MMP99I1
MMT-304	Data Engineering (2 credits)	MSU0325MML99I3
RP-307	Research Project (4credits)	MSU0325RP99I
	Major Elective	
MET-305	Big Data Analytics (4credits)	MSU0325MEL99I1
MET-306	Machine Learning (4credits)	MSU0325MEL99I2
M.Sc.Semester-IV		
MMT-401	Mobile Application Development(4 credits)	MSU0325MML99J1
MMT-402	Full Stack Development (4credits)	MSU0325MML99J2
MMPR-403	Practical-IV(4credits)	MSU0325MMP99J1
RP-406	Research Project (6 credits)	MSU0325RP99J
	Major Elective	
MET-404	Natural Language Processing (4credits)	MSU0325MEL99J1
MET-405	Agile Project Management (4 credits)	MSU0325MEL99J2

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)

Course Code: MMT-301

Title of Course: Advanced PHP

Internal Marks: 40 External Marks: 60

Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand core PHP concepts to create dynamic and interactive web pages.
2. Apply PHP for form handling, session management, file operations, and MySQL database connectivity.
3. Implement object-oriented programming and build structured web applications using Laravel framework.

UNIT I

(15 Hours)

Introduction to PHP: overview of modern PHP and its importance in web development, role of PHP as a server-side scripting language, key features and advantages of using PHP for dynamic web applications, environment setup: installing XAMPP, configuring VS Code and Composer, testing installation with phpinfo(), syntax and data handling: variables, constants, data types, operators, strings, echo and print statements, control structures: if-else, switch, match expressions, loops (for, while, foreach).

UNIT II (15 Hours)

Arrays And Functions: indexed and associative arrays, array methods (sort, merge), declaring functions with parameters and return types, use of superglobal variables ((\$_GET,\$_POST,\$_SESSION,\$_COOKIE),

Handling HTML forms with PHP: GET and POST methods, capturing and validating form data, sanitizing input using filter_var() and htmlspecialchars(), file management: reading and writing files (fopen, fwrite, fclose), uploading files securely with size and type validation, state management: understanding cookies and sessions, creating, retrieving, and deleting session data.

UNIT III

(15 Hours)

Database Connectivity with MySQL: overview of relational database concepts, primary and foreign keys, connecting PHP to MySQL using PDO or MySQLi, executing queries using prepared statements.

red statements to prevent SQL injection, performing CRUD operations: insert, select, update, and delete records using HTML forms and PHP.

UNIT IV

(15 Hours)

Object-oriented programming concepts in PHP: classes and objects, constructors and destructors, encapsulation and inheritance, method overriding and polymorphism, abstract classes, interfaces, static methods and properties, exception handling: try-catch-finally and custom exceptions.

Introduction to Laravel framework: MVC architecture, installation using Composer, environment configuration (.env file), core Laravel components: routes, controllers, models (Eloquent ORM), and Blade template views for dynamic frontend generation, CRUD application development in Laravel

References:

1. **Modern PHP 8.4**, Josh Lockhart, O'Reilly Media, 2025
2. **PHP & MySQL: Server-side Web Development**, Jon Nix, Wiley India, 2025
3. **Full-Stack PHP Development with Laravel**, Ravi Tamada (India), Packt India, 2025
4. **PHP 8.4 for Beginners**, Nitin Agrawal (India), BPB Publications, 2025

MSc Computer Science (Part II) (Level-6.5) (Semester III) (NEP-2020)

(Introduced from Academic Year 2026-27)

Title of Course: Data Science

Course Code: MMT-302 Total Credits: 04

Internal Marks: 40 External Marks: 60 Theory: 04 hours/week

Course Outcomes:

- 1) Understand the data preprocessing techniques for data science.
- 2) Understand data science and utilize data manipulation techniques and apply exploratory data analysis (EDA).
- 3) Understand fundamental statistical concepts used in data science.
- 4) Use the matplotlib library of Python for data visualization.
- 5) Understand the concept of dimensionality reduction in data science.

UNIT-I

(15 Hours)

Introduction to Data Science: Definition and scope of data science, Data science applications in different domains, Introduction to data-driven decision making. Data Collection and Preprocessing: Data types and sources, Data acquisition and storage, Data cleaning and handling missing values. Ethics and Privacy in Data Science: Ethical considerations in data collection and analysis, Protecting sensitive information and ensuring privacy.

UNIT-II

(15 Hours)

Exploratory Data Analysis (EDA): Data summarization and descriptive statistics, Data visualization techniques, Identifying patterns and outliers in data. Definition and Importance of EDA, Role of EDA in Data Science Lifecycle, Manual vs Automated EDA, Generating descriptive summaries, performing visual exploration using Matplotlib and Seaborn, developing correlation matrices and pair plots. Applying binning, grouping, splitting. Introduction to Python-based AutoEDA Libraries. Advanced AutoEDA techniques. Feature engineering with AutoEDA.

UNIT-III

(15 Hours)

Introduction to Statistics for Data Science: Probability distributions, Hypothesis testing, Correlation and regression analysis. Data Visualization: Introduction to data visualization tools (e.g., Matplotlib, Seaborn), Creating effective data visualizations, Design principles for data visualizations, Principal component analysis.

UNIT-IV**(15 Hours)**

Dimensionality reduction: Principal Component Analysis, principal components, Construction of the principal components, Working of PCA, Feature selection and visualization, High correlation filter, missing values ratio, Low variance filter, random forest, advantages and disadvantages of dimensionality reduction,

References:

1. John D. Kelleher and Brendan Tierney, Data Science., ISBN 9780262535434, The MIT Press.
2. Wes Mc Kinney, Python for Data Analysis, O'Reilly.
3. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Introduction to Statistical Learning.
4. JojoMoolayil, Smarter Decisions: The Intersection of IoT and Data Science, PACKT, 2016.
5. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly, 2015.
6. David Dietrich, Barry Heller, Beibei Yang, Data Science and Big data Analytics, EMC 2013
7. Python for Data Analysis (4th Edition) – Wes McKinney, O'Reilly Media, 2025.
8. Data Science from Scratch (2nd Edition) – Joel Grus, O'Reilly Media, 2025.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2026-27)

Title of Course: Practical-III

Course Code: MMPR-303

Total Credits: 04

Internal Marks: 40

External Marks: 60

Practical: 08 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To provide students with a basic grasp of PHP as a server-side scripting language.
2. To instruct students in PHP syntax and core language features, such as variables, data types, operators, and control structures.
3. To enable students to use PHP for web development, including creating dynamic web pages, managing forms, and interacting with databases.
4. To teach students how to connect PHP with databases like MySQL and perform CRUD operations.
5. To teach students the concept of PHP framework and integration of database system into the framework and perform CRUD (Create, Read, Update, Delete) operations.
6. To learn and implement data science concepts using python.

Practical's will be based on MMT-301 and MMT-302

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)

Course Code: MMT-304

Title of Course: Data Engineering

Internal Marks: 20 External Marks: 30 Theory: 02 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand basic data storage systems (SQL/NoSQL) and their use cases.
2. Design simple database schemas and perform basic CRUD operations.
3. Explain data pipeline concepts and ETL processes.
4. Recognize cloud storage services and their role in modern data engineering.

UNIT I – Data Storage Systems (15 Hours)

Data Storage Fundamentals: Role of data storage in analytics, types of data storage systems, understanding structured vs unstructured data. **Relational Databases (SQL):** Tables, primary/foreign keys, basic normalization, simple SELECT/INSERT/UPDATE/DELETE queries, indexing for performance. **NoSQL Databases:** Document stores (MongoDB), key-value stores (Redis), when to use SQL vs NoSQL.

UNIT II – Data Pipelines & Cloud Storage (15 Hours)

Data Pipelines Basics: ETL process (Extract, Transform, Load), data flow from source to destination, batch vs real-time processing. **Data Warehousing:** Purpose of data warehouses, OLTP vs OLAP, simple star schema concept. **Cloud Storage Services:** AWS S3 (object storage), Google BigQuery (warehouse), Azure Blob Storage, basic cloud storage patterns.

References:

1. Data Engineering Cookbook – Andreas Kretz (pipelines/storage basics)
2. Fundamentals of Data Engineering – Joe Reis & Matt Housley (cloud/warehousing)

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2026-27)

Title of Course: Research Project

Course Code: RP-307

Total Credits: 04

Internal Marks: 40 External Marks: 60

Practical: 8 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. find current research domains in computer science
 2. identify different research journals in computer science domains
 3. understand citations, impact factors, references etc.
 4. identification of appropriate societal issues.
 5. development of applications to address identified societal issue.
-
- Student has to identify research problem in the semester-III and have to carry out thorough literature review / student can develop a application project which will address societal issues.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)

Course Code: MET-305

Title of Course: Big Data Analytics

Internal Marks: 40 External Marks: 60

Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Explain Big Data concepts, characteristics, challenges, architecture, and differences from traditional data systems.
2. Perform basic data operations using Hadoop ecosystem tools—HDFS, YARN, Hive, HBase, and Cassandra.
3. Apply Spark and PySpark for data transformation, querying, and machine learning on large datasets.
4. Implement real-time data analytics using Apache Kafka and Spark Streaming for event-driven insights.

UNIT I

(15 Hours)

Overview of digital data and data types (structured, semi-structured, unstructured), characteristics and challenges of big data, 4Vs and business impact, difference between traditional data processing and big data analytics. Concept of Data Warehouse vs Data Lake, introduction to Data Science workflow, CAP theorem and BASE properties, basics of distributed computing and scalability.

UNIT II

(15 Hours)

Overview of Big Data tools and ecosystems (Hadoop, Spark, Kafka, NoSQL systems), understanding data privacy, governance, and ethics. Hadoop architecture, HDFS – block structure, data replication, fault tolerance, YARN basics and resource management, command-line operations. Introduction to Hadoop ecosystem tools – Hive for querying, HBase and Cassandra for NoSQL storage, schema-on-read principle.

UNIT III

(15 Hours)

Use cases of Hadoop in cloud environments, understanding the shift from MapReduce to

Spark for faster analytics. Introduction to Apache Spark framework, Spark architecture and components, RDDs, DataFrames, and Spark SQL for structured analysis. Performing basic transformations and actions in PySpark, data analysis and preprocessing, introduction to Spark .

UNIT IV

(15 Hours)

Basics of real-time data processing and its importance, introduction to Apache Kafka. Apache Kafka for real-time ingestion. Spark architecture (RDDs, DataFrames, Catalyst optimizer), PySpark for batch/streaming, Delta Lake/Unity Catalog lakehouse, serverless big data (AWS Glue, Databricks Serverless), edge computing basics.

References:

1. Tom White – Hadoop: The Definitive Guide, O'Reilly (latest edition).
2. Jules S. Damji – Learning Spark: Lightning-Fast Data Analytics, O'Reilly.
3. Databricks and Apache Spark Official Documentation (2025).
4. Delta Lake: The Definitive Guide (O'Reilly, 2024) .
5. Serverless ETL and Analytics with AWS Glue by Michael Wall (Packt)

Master of Science Part II Semester III
(NEP-2020)
To be implemented from the academic year 2026-2027
Course Code: MET-306
Title of Course: Machine Learning

Internal Marks: 40

External Marks: 60

Theory: 04 hours/week

Course Outcome

1. To understand fundamental concepts of machine learning and its various algorithms
2. To understand various strategies of generating models from data and evaluating them
3. To apply ML algorithms on given data and interpret the results obtained
4. To design appropriate ML solution to solve real world problems in AI domain

Unit-I (15 Hours)

Introduction to Machine learning, essential concepts in Machine learning, Machine learning basics: Key terminology, Key tasks of machine learning, Types of learning, choosing the right algorithm, Steps in developing a machine learning application. Regression: Linear Regression, Best Fit Line in Linear Regression. Minimizing the Error: The Least Squares Method, Multiple Linear Regression, Evaluation Metrics for Linear Regression.

Unit-II (15 Hours)

Classification : Supervised Learning, k-Nearest Neighbours classification algorithm, distance metrics, and the concept of K in KNN, binary and multi-label classification using KNN. Decision tree, entropy, Gini index, Information gain, Tree construction.

Unit-III (15 Hours)

Naïve Bayesian decision theory, Conditional probability, classifying with conditional probabilities, Document classification with naïve Bayes, classifying spam email with naïve Bayes. Support Vector Machines (SVM) - Introduction, goal of SVM, Working of SVM, Support Vectors, Hyperplane, Margin, SVM Kernels: Polynomial Kernel, Radial Basis Function (RBF) Kernel, Pros and Cons of SVM Classifiers.

Unit-IV (15 Hours)

Recommender System: Introduction, Understanding Recommendation Systems, different types (collaborative filtering, content-based, hybrid). Content Based Filtering: content-based filtering methods, such as TF-IDF and cosine similarity, Collaborative Filtering: Explore collaborative filtering techniques, including user-based and item-based approaches, Issues in Recommendation Systems.

References:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press (23 April 2020)
2. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition
3. Aurélien Geron Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, Inc. 2nd Edition

4. Illustrated edition Christopher M. Bishop Pattern Recognition and Machine Learning - Springer, 2nd edition
5. Trevor Hastie, Robert Tibshirani, and Jerome Friedman - The Elements of Statistical Learning: Data Mining, Inference, and Prediction - Springer, 2nd edition
6. Supervised Machine Learning with Python: Develop rich Python coding practices while exploring supervised machine learning by Taylor Smith
7. Fundamentals of machine learning for predictive data analytics : algorithms, worked examples, and case studies / John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy.
8. Machine Learning Systems Principles and Practices of Engineering Artificially Intelligent Systems, Vijay JanapaReddi

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)

Course Code: MMT-401

Title of Course: Mobile Application Development

Internal Marks: 40 External Marks: 60

Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To introduce Android and Flutter ecosystems for mobile application development.
2. To impart practical knowledge of Kotlin and Dart languages in building visually appealing and responsive UIs.
3. To enable students to integrate local databases and APIs within mobile apps.
4. To provide hands-on experience in deploying apps to emulators and real devices.
5. To foster cross-platform development awareness with Flutter.

UNIT I

(15 Hours)

Introduction to the Android platform, its ecosystem, and app development flow. Setting up Android Studio, working with emulator (AVD) or a physical device. Overview of main app components: Activities, Services, Broadcast Receivers, Content Providers, and AndroidManifest.xml. Creation of a basic Android app using Kotlin and Jetpack Compose. Understanding Composable functions, setContent(), and layout structures like Text, Button, Row, and Column. Introduction to Material 3 design and simple UI styling using Modifiers (padding, color, alignment).

UNIT II

(15 Hours)

Understanding Activity lifecycle and its connection to Jetpack Compose screens. Creating user-input forms using TextField, Button, Snackbar, and basic dialogs. Managing state with remember and mutableStateOf, and building responsive UIs. Using Compose Navigation for multi-screen apps, and working with explicit and implicit Intents to share data or open other apps. Introduction to Scaffold, TopAppBar, FAB, and basic UI theming.

UNIT III

(15 Hours)

Developing list-based UIs using LazyColumn/LazyRow for efficient scrolling content.

Introduction to data storage options — SharedPreferences, SQLite, and Room Database. Building a simple data-driven app like a Notes or To-Do app with Room (Entity-DAO-Database pattern). Basic understanding of UI data updates through ViewModel. Overview of app packaging, signing and publishing, creating release APKs, and preparing for Play Store submission.

UNIT IV

(15 Hours)

Introduction to Flutter as a cross-platform toolkit for Android and iOS app development. Installation and setup of Flutter SDK and Android Studio plugin. Basics of Dart language: variables, loops, conditionals, functions, and objects. Creating a simple Flutter app using widgets like Text, Image, Button, and TextField. Understanding StatelessWidget vs StatefulWidget, hot reload, and layout widgets such as Row, Column, and Container.

References:

1. Professional Android Development with Kotlin, Sebastian Kaspari, Wrox, 2025
2. Flutter Apprentice (4th Edition), Ray Wenderlich Team, Ray Wenderlich LLC, 2025
3. Modern Android Development with Kotlin, Dr. JillurRahman , Technical Publications, 2025
4. Jetpack Compose Android Development, Ravi Tamada, Packt India, 2025
5. Kotlin Android Programming, Nitin Agrawal , Pearson India, 2025
6. Mobile Application Development with Flutter, Sanjay P. Singh , Khanna Publishers, 2025
7. Android with Kotlin and Jetpack Compose, PravinKumar , Technical Publications, 2025

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)

(Introduced from Academic Year 2026-27)

Course code: MMT-402

Title of Course: Full Stack Development

Total Credits: 04

Internal Marks: 40 External Marks: 60

Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand the unique trade-offs present in event-driven programming.
2. Create Node.js modules and express code modularity in an application.
3. Understand the core flow control patterns in Node.js and know when it is appropriate to use callbacks, event emitters or streams
4. Connect with MongoDB to perform various operations

UNIT I (15 Hours)

NodeJS: Introduction to Nodejs, Architecture of Nodejs Application, Advantages of Node JS, Synchronous and Asynchronous Programming, Call back Function in nodejs, Promises in Nodejs, Mongodb with Nodejs, Design the Schema in Nodejs, Design the Rest API's, GET, POST, PUT, DELETE, JSON web Token Authentication in nodejs, Create the Auth APP in nodejs

UNIT II (15 Hours)

NodeJS Modules: Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module.Exports, NPM, Installing Packages Locally, Adding dependency in package.json, installing packages globally, updating packages, Fs.readFile, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO Operations, When to use Event Emitters, Binding Functions to Events, Event Requests, Event Listening

UNIT III (15 Hours)

MongoDB: Introduction to MongoDB (No-sql), Difference between NoSQL and RDBMS, Benefits of NoSQL, Objectives, Design Goals, The Mongo Shell, JSON Introduction, JSON

Structure, Collections in MongoDB, Documents In mongoDb, Inserting data into database, Filter queries in Mongoddb Database, Schema Validation in MongoDB database, Indexing In collections, Aggregation in MongoDB, Embedded Document in MongoDB

UNIT IV

(15 Hours)

Schema Design Pattern, Case Studies & Tradeoffs, Storage Classes, Automatic Storage Class, Static Storage Class, External Storage Class, Register Storage Class, Performance Using Indexes, Monitoring And Understanding Performance, Performance In Sharded Environments, Aggregation Framework Goals, The Use of The Pipeline, Comparison With SQL FacilitiesExpressJS:Overview of Express.js and its role in web application development, Defining routes for handling different HTTP methods and URLs,Creating and using middleware functions for various purposes, Integrating and using templating engines, Serving static files with Express.js.

References:

1. Node.js web development by David Herron
2. Beginning Node.js, Express &MongoDB Development by Greg Lim
3. Node.js Design Patterns by Mario Casciaro and Luciano Mammino

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2026-27)

Title of Course: Practical-IV

Course Code: MMPR-403

Total Credits: 04

Internal Marks: 40 External Marks: 60

Practical: 8 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understanding Web Development, Front-End Development: Teach students how to create responsive and interactive user interfaces using HTML, CSS, and JavaScript.
2. Back-End Development: Introduce students to server-side programming and database management, typically using languages like Node.js, Python, Ruby, Java, or PHP, along with frameworks like Express, Flask, or Django.
3. Database Integration: Teach students how to design, create, and manage databases, including SQL and NoSQL databases like MySQL, PostgreSQL, MongoDB, or Firebase.

Practical will be based on MMT-402.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2026-27)

Title of Course: Research Project

Course Code: RP-406

Total Credits: 06

Internal Marks: 60 External Marks: 90

Practical: 10 hours/week

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. investigate and design a model for research problem identified.
 2. implementation of model with appropriate software tools.
 3. benchmark the experimental results.
 4. writing a research article.
 5. identification of appropriate societal issues.
 6. development of applications to address identified societal issue.
-
- Students have to design a model and implement for the research problem identified in semester-III / student can carry out a project which will address societal issues.
 - It is preferable to publish the research work carried out in the form of Seminar/ Workshop/ Conference proceedings /Research journal publications.

M.Sc.(Computer Science)(Part-II)(Semester-IV)
(Introduced from Academic Year 2026-27)

Title of Course: Natural Language Processing Course Code: MET-404

Internal Marks: 40

External Marks: 60

Theory: 04 hours/week

Course Outcomes: Upon successful completion of this course, student will be able to:

1. To learn the fundamentals of natural language processing.
2. Analyze linguistic structures using morphology, finite state models, and part of speech tagging.
3. Implement syntactic parsing techniques using grammars and statistical parsing algorithms. Interpret semantic meaning using lexical semantics, sentiment analysis, and word sense disambiguation.
4. Develop basic NLP applications using Python and NLTK for real-world text processing tasks.
5. Interpret semantic meaning using lexical semantics, sentiment analysis, and word sense disambiguation.
6. Apply text preprocessing, normalization, and language modeling techniques for NLP tasks.

UNIT I (15 Hours)

Introduction to NLP, history, NLP application: Speech of Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, Machine Translation, Text Normalization: Basic pre- processing, Word and Sentence segmentation, Lemmatization, Stemming, Morphology, Language Models: N-gram models, smoothing technique.

UNIT II (15 Hours)

Linguistic essentials: Lexical syntax-Morphology, Finite State Transducers, Part of speech tagging, rule based Part of Speech Tagging, Markov Model, Hidden Markov Models. Syntax Parsing: Regular and Context-Free Languages, Context-Free Parsing, Parsing with Context Free Grammars, Unification, Statistical parsing and probabilistic CFG, CKY Algorithm.

UNIT III (15 Hours)

Semantic Analysis: Semantic Analysis meaning, Lexical semantics, Supervised, Dictionary based and Unsupervised Approaches, Compositional semantics Semantic Role Labeling and Semantic Parsing. Lexicons for sentiments: Defining Emotion, Available and Affect Lexicons, Semi-supervised, Supervised learning of word sentiment. Phonetics: Speech Sound and Phonetics Transcription, Lexical Semantics, word senses and relationships, WordNet, Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, Coreferences Resolution: Anaphora, Cataphora.

UNIT IV (15 Hours)

Getting Started with Python, Getting Started with NLTK, Texts as Lists of Words, Lists, Indexing Lists, Variables, Strings, Word Sense Disambiguation, Pronoun Resolution, Generating Language Output, Machine Translation, Spoken Dialogue

Systems, Processing Raw Text- Accessing text from the web and from disk, Regular Expression for Tokenizing Text, Formatting: From lists to Strings, Sequences, Questions of Style, Functions, Structure of Python Module, Algorithm Design.

References

1. Handbook of Natural Language Processing Indurkha, N., & Damerau, F.J.CRC Press Taylor and Francis Group 2nd 2010.
2. SpeechandLanguageProcessingMartin,J.H.,&Jurafsky,D.PearsonEducation India 2nd 2013.
3. FoundationsofStatisticalNaturalLanguageProcessingManning,Christophe and Heinrich, Schutze MIT Press 1st 1997
4. Natural Language Processing With Python Steven Bird, Edward Loper O'Reilly Media 2nd 2016

M.Sc.(Computer Science)(Part-II)(Semester-IV)
(Introduced from Academic Year 2026-27)

Title of Course: Agile Project

Management Course Code: MET-405

Internal Marks: 40

External Marks: 60

Theory: 04 hours/week

Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand the principles of Agile Manifesto.
2. Learn the project management approaches.
3. Understand concept of Scrum its values and roles.
4. Apply agile project constraints and trade-offs for estimating project size and schedule.
5. Analyze the characteristics and dynamics of high-performing Scrum teams using the Scrum Guide.
6. Design and evaluate value roadmaps and product roadmaps.

UNIT I (15 Hours)

Introduction, A brief history of Agile, Distinguishing Agile from Waterfall, The four values of the Agile Manifesto, The 12 principles of the Agile Manifesto, Adopting an Agile mindset, Applying Agile in a VUCA environment, Introduction to Scrum-Introduction to Kanban, XP, and Lean, Blending project management approaches, Adopting an Agile mindset: The Agile Manifesto, principles of Scrum, Spotify model.

UNIT II (15 Hours)

Scrum Introduction: Scrum, The three pillars of Scrum, The five values of Scrum Essential Scrum roles, Traits of an effective Scrum Master, Pete: Master, Traits of an effective Product Owner, Traits of an effective Development Team, The Scrum Guide, Scrum Team roles, Characteristics of a Scrum Team.

UNIT III (15 Hours)

Introduction: Implementing Scrum, Building a Product Backlog, Writing user stories, Create a product backlog in Asana, Backlog refinement and effort estimation, Adding estimation in Asana, Introduction to the Sprint: Sprint planning, Create and manage Sprints in Asana The Daily Scrum and Sprint Review, Sarah: The benefits of a Daily Standup The Sprint Retrospective, Velocity and burndown charts, Utilizing Kanban boards, Tools for transparency and collaboration.

UNIT IV (15 Hours)

Introduction: Applying Agile in the organization, Maximizing value-driven, delivery-Camron: How Agile can drive value, Components of a value roadmap, Creating an effective value roadmap, Facilitating organizational change, Coaching an Agile team, Agile team challenges, Common Agile coaching challenges, Case study: Forming a value-driven task force, Product roadmaps: Benefits, pitfalls, and best practices, responding to change over following a plan. ActivityExemplar: Make changes to your release plan, the influencer change framework, coaching versus managing in Agile.

Reference Books:

1. Agile for Project Managers: Denise Canty, CRC Press
2. Agile Project Management for Dummies, 2nd Edition Mark C. Layton, Steven J. sternmiller
3. Agile Estimating and Planning by Mike Cohn Robert C Martin Series
4. Introduction to Software Project Management by Adolfo Villafiorita, CRC Press
5. Agile Project Management with Scrumby Ken Schwaber, Microsoft Press © 2004
6. Agile Project Management: Creating Innovative Products (2nd Edition) by Jim Highsmith, AddisonWesley Professional
7. Agile Project Management QuickStart Guide: The Simplified Beginners Guide to Agile Project Management by Clyde Bank Business