Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

(An Autonomous College)

Accredited by NAAC with 'A^{+}' grade

Affiliated to Shivaji University, Kolhapur

Structure and Syllabus in Accordance with

National Education Policy - 2020

with Multiple Entry and Multiple Exit

Master of Science
(Computer Science)
Part II

under

Faculty of Science and Technology

(To Be Implemented From Academic Year 2024-25)

Programme Structure

Structure in Accordance with National Education Policy - 2020 With Multiple Entry and Multiple Exit Options

M.Sc. (Computer Science) Part – I (Level-6.0)

	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-I										
Major Mandatory	MJ-MCST23-101	4	--	4	80	32	3	20	8	1
	MJ-MCST23-102	4	--	4	80	32	3	20	8	1
	MCSP23-103	--	8	4	80	32	3	20	8	1
	MJ-MCST23-104	2	--	2	40	16	2	10	4	1
Major Elective	**GE-MCST23-105**	4	--	4	80	32	3	20	8	1
	GE-MCST23-106									
Research Methodology	RM-107	4	--	4	80	32	3	20	8	1
Total				22	440			110		
Semester-II										
Major Mandatory	MJ-MCST23-201	4	--	4	80	32	3	20	8	1
	MJ-CST23-202	4	--	4	80	32	3	20	8	1
	MCSP23-203	--	8	4	80	32	3	20	8	1
	MJ-MCST23-204	2	--	2	40	16	2	10	4	1
Major Elective	GE-MCST23-205	4	--	4	80	32	3	20	8	1
	GE-MCST23-206									
OJT/FP	OJT-207	--	--	4	*					
Total				22	440			110		
Total (Sem I + Sem II)				44						

<table>
<tr><td>• MMT–Major Mandatory Theory
• MMPR–Major Mandatory Practical
• MET–Major Elective Theory
• MEPR–Major Elective Practical
• RM - Research Methodology
• OJT/FP- On Job Training/ Field Project</td><td>• Total Marks for M.Sc.-I : 1100
• Total Credits for M.Sc.-I (Semester I & II) : 44
• Separate passing is mandatory for University and Internal Examinations</td></tr>
<tr><td colspan="2">*Evaluation scheme for OJT/FP shall be decided by concerned BOS</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.0: Completion of Level 5.5</td></tr>
<tr><td colspan="2">• Requirement for Exit after Level 6.0:
Students can exit after completion of Level 6.0 with Post Graduate Diploma in Computer Science</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.5: He/ She have completed MSc Part-I (Level 6.0)</td></tr>
</table>

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 (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-III										
Major Mandatory	MJ-CST24-301	4	--	4	80	32	3	20	8	1
	MJ-CST24-302	4	--	4	80	32	3	20	8	1
	MJ-CSP24-303	--	8	4	80	32	3	20	8	1
	MJ-CST24-304	2	--	2	40	16	2	10	4	1
Major Elective	GE-CST24-305	4	--	4	80	32	3	20	8	1
	MET-306									
Research Project	RP-24-307	--	--	4	80	32	--	20	8	--
Total				22	440			110		
Semester-IV										
Major Mandatory	MJ-CST24-401	4	--	4	80	32	3	20	8	1
	MJ-CST24-402	4	--	4	80	32	3	20	8	1
	MJ-CSP24-403	--	8	4	80	32	3	20	8	1
Major Elective	GE-CST24-404	4	--	4	80	32	3	20	8	1
	MET-405									
Research Project	RP-24-406	--	--	6	100	40	--	50	20	--
Total				22	420			130		
Total (Sem III + Sem IV)				44						

• MJ-CST –Major Mandatory Theory • MJ-CSP–Major Mandatory Practical • GE-CST –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 Research Project shall be decided by concerned BOS	
## Evaluation scheme for Research Project shall be decided by concerned BOS	
• **Requirement for Exit after Level 6.5:** **Students can exit after completion of Level 6.5 with Master of Computer Science**	

Course Codes

M.Sc. Semester-I	
Course Code	**Major Mandatory**
MJ-MCST23-101	Design and Analysis of Algorithms (4 credits)
MJ-MCST23-102	Advanced Database Management System (4 credits)
MJ-MCSP23-103	Practical-I (4 credits)
MJ-MCST23-104	Web Design (2 credits)
RM-MCST23-106	Research Methodology (4 credits)
	Major Elective
GE-MCST23-105	Cyber Security (4 credits)
GE-MCST23-105A	Cloud Computing (4 credits)
M.Sc. Semester-II	
	Major Mandatory
MJ-MCST23-201	Advanced Java (4 credits)
MJ-MCST23-202	Artificial Intelligence (4 credits)
MJ-MCST23-203	Practical-II (4 credits)
MJ-MCST23-204	Angular JS (2 credits)
OJT/ FP MCP23-207	Internship (4 credits)
	Major Elective
GE-MCST23- **205**	Image Processing (4 credits)
GE-MCST23- **205A**	Block Chain Technology (4 credits)
M.Sc. Semester-III	
	Major Mandatory
MJ-MCST24-301	Advanced PHP (4 credits)
MJ-MCST24-302	Data Science (4 credits)
MJ-MCSP24--303	Practical-III (4 credits)
MJ-MCST24-304	Data Engineering (2 credits)
RP-MCSP24-306	Research Project (4 credits)
	Major Elective
GE-MCST24-305	Machine Learning (4 credits)
GE-MCST24-305A	Big Data Analytics (4 credits)
M.Sc. Semester-IV	
MJ-MCST24-401	Mobile Application Development (4 credits)
MJ-MCST24-402	Full Stack Development (4 credits)
MJ-MCSP24-403	Practical-IV (4 credits) (4 credits)
RP-24- MCSP24-405	Research Project (4 credits)
	Major Elective
GE-MCST24-404	Natural Language Processing (4 credits)
GE-MCST24-404A	Agile Project Management (4 credits)

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Advanced PHP
Course Code: MJ-MCST24-301
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To introduce students to the PHP programming language and its role in web development.
2. To enable students to write PHP code for web applications.
3. To teach students how to integrate PHP with HTML for dynamic web content.
4. To provide hands-on experience in working with PHP to interact with MySQL databases.
5. To encourage problem-solving and critical thinking through practical coding exercises.

UNIT I **(15 Hours)**

Introduction of PHP, variables, echo and print, data types, operators, strings, constants, decision making, loops, superglobals, expressions, PHP Arrays, PHP Strings, PHP function.

UNIT II **(15 Hours)**

Handling HTML forms with PHP: HTML forms work, capture form data with PHP, multi value fields, web forms with PHP, storing PHP variables in forms, create file upload forms, redirecting in PHP, Cookies, Sessions, working with files. Introduction to MySQL databases, Connecting PHP to a MySQL database. PHP CRUD with MYSQL.

UNIT III **(15 Hours)**

OO Concepts, Define Class, Class Attributes, Creating an Object, constructors and destructors, Static Method, Abstract Class, Inheritance, Exception handling in PHP.
Introduction of Laravel Framework, Features of Framework, Models, Views, Controllers, Setting environment of framework, Creating Laravel App.

UNIT IV **(15 Hours)**

Introduction of Ajax, Architecture, Overview of Important Concepts of Javascript, XMLHttpRequest, Onreadystatechange, Ajax using HTML, Javascript& DOM, Ajax using PHP & MySQL.

References:

1. Matt Doyle, Beginning PHP 5.3,Wiley India Edition,2012 .
2. PHP6 and MySQL, Steve Suehring, Tim Converse and Joyce Park, Wiley India 2010, Second Edition.
3. VikramVaswani, PHP: A Beginners guide,TataMcgraw Hill,2009.
4. Core PHP Programming" by Atkinson Leon, SuraskiZeev, Pearson Publication
5. Larry Ullman, PHP 6 and MySQL 5,Pearson Education,2008.
6. Laravel: Up & Running: A Framework for Building Modern PHP Apps by Matt Stauffer Oreilly.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Data Science
Course Code: MJ-MCST24-302
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Learn basic statistics required for data science.
2. Visualize the data in different forms.
3. Learn and implement different visualization tools for data science.
4. Learn, understand and apply the concepts of probability theory for data science.
5. Learn and apply various clustering techniques for data science.
6. Learn and implement data science concepts in python.

UNIT I **(15 Hours)**

Data Preprocessing: need of data preprocessing, descriptive data summarization, data cleaning, data integration and transformation, data reduction, Introduction to Statistics, Difference between inferential statistics and Descriptive statistics, Inferential Statistics- Drawing Inferences from Data, Random Variables, Normal Probability Distribution, Sampling, Sample Statistics and Sampling Distributions,

UNIT II **(15 Hours)**

Introduction to data visualization, History of Data Visualization, importance of data visualization, advantages and disadvantages of data visualization, data visualization examples, types of data visualization charts: line, bar, pie, box plots, scatter plot, histogram, difference between data mining and data visualization, tools and software of data visualization, Data Visualization Tools in Python- Introduction to Matplotlib, Basic plots using matplotlib, Advanced Visualization Tools: Seaborn, Plotly, Dash, folium,Waffle Charts, Word Clouds.

UNIT III **(15 Hours)**

Introduction to probability, Random variables, probability distributions, marginal probability, conditional probability, The Chain rule of conditional probabilities, Independence and conditional independence, expectation, variance and co-variance, Useful properties of common functions. Linear models and regression analysis.

UNIT IV **(15 Hours)**

Cluster analysis: meaning of cluster analysis, requirement for cluster analysis, overview of basic clustering methods, Partition methods: k-means and k-medoids, Hierarchical methods: Agglomerative versus Divisive hierarchical clustering, distance measures in algorithmic methods, probabilistic hierarchical clustering, DBSCAN, Evaluation of clustering.

References:

1. Data Mining concepts and techniques -- Jiawei Han And MichelineKamber, Elsevier
2. Data /mining: Introductory and Advanced Topics -- Margaret H. Dunham, Pearson Education.
3. Introduction to Data Mining -- Pang Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.
4. Deep Learning Vol. 1, Ian Goodfellow, YoshuaBengio, Aaron Courville, Cambridge:MIT press.
5. Introduction to probability models, Ross, S.M., Academic Press.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Practical-III
Course Code: MJ-MCSP24-303
Total Credits: 04
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)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Data Engineering
Course Code: MJ-MCST24-304
Total Credits: 02
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To introduce students to data storage systems and technologies commonly used in data engineering.
2. To enable students to design and implement databases for efficient data storage and retrieval.
3. To teach students how to optimize data storage and access patterns for performance.
4. To explore data security and privacy considerations in data engineering.
5. To provide experience in using cloud-based storage and database services.

UNIT I **(15 Hours)**

Data Pipeline, Data Flow: the flow of data through different stages of processing, transformation, and storage within a data engineering ecosystem.
Data Storage and Retrieval: Knowledge of various data storage technologies, such as relational databases (SQL) and NoSQL databases.
Data Processing and Transformation: data processing frameworks and tools, like Apache Spark, for handling large-scale data processing and transformation tasks.

UNIT II **(15 Hours)**

Data Integration and ETL (Extract, Transform, Load), Data Warehousing, Big Data Technologies: such as Hadoop ecosystem components (e.g., HDFS, MapReduce) and Apache Kafka for handling real-time data streams.
Cloud Computing for Data Engineering: Understanding the benefits of cloud-based data engineering and working with cloud data storage and processing platforms like AWS, Azure, and Google Cloud Platform.

References:

1. "Data Engineering" by Pramod J. Sadalage and Martin Fowler
2. "Data Engineering Cookbook" by Andreas Kretz

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Big Data Analytics
Course Code: GE-MCST24-305
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:
1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Understanding different tools for Big Data Analytics.
3. Develop Big Data Solutions using Hadoop Eco System

UNIT I **(15 Hours)**

Introduction to Big Data: Types of Digital Data-Characteristics of Data - Evolution of Big Data –Definition of Big Data - Challenges with Big Data - 4Vs of Big Data - Non Definitional traits of Big Data –Business Intelligence vs. Big Data - Data warehouse and Hadoop environment - Coexistence. Big Data Analytics: Classification of analytics - Data Science - Terminologies in Big Data - CAP Theorem - BASE Concept.

UNIT II **(15 Hours)**

Hadoop Eco systems: The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features- Combiner - Partitioner - Searching - Sorting - Compression. Hadoop 2 (YARN): Architecture - Interacting with Hadoop Eco systems.

UNIT III **(15 Hours)**

Pig: Introduction to PIG, Execution Modes of Pig, Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Introduction to DB2, BigSQL. Cassandra: Introduction - Features - Data types - CQLSH - Key spaces -Connecting to Cassandra CRUD operations - Collections - Counter - TTL - Alter commands - Import and Export - Querying System tables.

UNIT IV **(15 Hours)**

Machine Learning and Data Analytics with Python: Quick into machine learning, bigdata and machine learning, Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Big Data Analytics with Python, machine learning tools SPARK AND SPARKML, H2O. Spark Programming(Python and PySpark),Spark-RDD(Resilient Distributed Data Set, Dataframes, Sparl SQL, PySpark ,Code optimization, Cluster Configurations, Distributed File Storage System

References:

1. “Professional Hadoop Solutions”, Boris lublinsky, Kevin t. Smith, AlexeyYakubovich Wiley, ISBN: 9788126551071, 2015.
2. “Understanding Big data”, Chris Eaton,Dirkderoos. McGraw Hill, 2012.
3. BIG Data and Analytics, SimaAcharya, SubhashiniChhellappan, Willey 4
4. Tom White, Hadoop: The Definitive Guide, O’Reilly, 3rd edition
5. “Oracle Big Data Handbook”, Tom Plunkett, Brian Macdonald ,Oracle Press, 2014.
6. Hadoop in Practice, Alex Holmes, manning 1st edition.
7. “Oracle Big Data Handbook”, Tom Plunkett, Brian Macdonald ,OraclePress, 2014.
8. “Big Data and Business analytics”, JyLiebowitz, CRC press, 2013

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Machine Learning
Course Code: GE-MCST24-306
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

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, choosing the right algorithm, Steps in developing a machine learning application. Supervised learning the k-Nearest Neighbours classification algorithm, Parsing and importing data from a text file,

UNIT II **(15 Hours)**

Creating scatter plots with Matplotlib, Normalizing numeric values. Decision tree, Tree construction, plotting trees in Python, Testing and storing the classifier, Naïve Bayesian decision theory, Conditional probability, classifying with conditional probabilities, Document classification with naïve Bayes, classifying text with python, classifying spam email with naïve Bayes.

UNIT III **(15 Hours)**

Support Vector Machines (SVM) - Introduction , goal of SVM, Working of SVM , Support Vectors , Hyper plane, Margin Model evaluation and improvement, Regularization, Bias Variance, Hyper- parameter Tuning, SVM Kernels: 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, Content Based Filtering, User Based Collaborative Filtering, Item Based Collaborative Filtering, Methods and tricks of the trade, metrics and evaluation of Recommendation Systems.

References:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning,
2. Cambridge University Press (23 April 2020)
3. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition
4. AurélienGéron Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly
5. Media, Inc. 2nd Edition
6. Illustrated edition Christopher M. Bishop Pattern Recognition and Machine Learning - Springer, 2nd edition
7. Trevor Hastie, Robert Tibshirani, and Jerome Friedman - The Elements of Statistical Learning: Data Mining, Inference, and Prediction - Springer, 2nd edition

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Research Project
Course Code: RP-MCSP24-306
Total Credits: 04
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 application project which will address societal issues.

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Mobile Application Development
Course Code: MMT-401
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1) Learn about the features and installation of Android and kotlin
2) Learn about basic programming with Android Kotlin
3) Develop mobile applications using database Connections
4) Develop simple mobile applications in Flutter using Dart language
5) Learn to Create a full-fledged mobile app and deploy

UNIT I **(15 Hours)**

Introduction to Android platform and the Android Studio IDE, Android Architecture, Setting up development environment, How to create project in Android Studio using Kotlin, Deploying sample application on a real device, Emulator-Android Virtual Device, Android Manifest.xml, Resources & R.java Activity lifecycle, Android Components-Activities, Services, Broadcast Receivers & Content providers,

UNIT II **(15 Hours)**

Activities and Activity lifecycle. First sample Application Views & notifications, Components for communication -Intents & Intent Filters ,Android TextView and EditText, Kotlin Android Toast, Android Button, Android Custom Toast, Android Explicit Intent, Android Implicit Intent,

UNIT III **(15 Hours)**

Android ListView, Recycler View, Adapters, Introduction to SQLite Database, Using Room Persistence Library, Data Saving, Retrieving, Loading, Storing Data in your app, Storing Data using SQLite, Kotlin Android SQLite Database CRUD, publishing app.

UNIT IV **(15 Hours)**

Features of Flutter- Advantages of Flutter- Disadvantages of Flutter. Flutter Installation-Installation in Windows, Creating Simple Application in Android Studio - Architecture of Flutter Applications Widgets- Gestures- Concept of State- Layers- Introduction to Dart Programming-Variables and Data types- Decision Making and Loops. Functions. OOP, Introduction to Widgets- Widget Build Visualization, Type of Layout Widgets- Single Child Widgets- Multiple Child Widgets- Advanced Layout Application-Introduction to Gestures-Statement Management in Flutter.

References:

1. Professional Android 4 Application Development Reto Meier Wrox
2. Android Application Development: Programming with the Google SDK 2009 by Rick Rogers, John Lombardo, Zigurd Mednieks, G. Blake Meike
3. Beginning App Development with Flutter by Rap Payne
4. .Flutter in Action by Eric Windmill
5. Marco L. Napoli, "Beginning Flutter: A Hands on Guide to App Development™, John

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Full Stack Development
Course Code: MMT-402
Total Credits: 04
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 Mongodb 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 Facilities ExpressJS: 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 2024-25)

Title of Course: Practical-IV
Course Code: MMPR-403
Total Credits: 04
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.
4. Learn about basic programming with Android Kotlin
5. Develop mobile applications using database Connections
6. Develop simple mobile applications in Flutter using Dart language.
7. Learn to Create a full-fledged mobile app and deploy

Practical's will be based on MMT-401 and MMT-402

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Natural Language Processing
Course Code: MET-404
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To learn the fundamentals of natural language processing.
2. Understand approaches to syntax and semantics in NLP.
3. To understand the use of CFG and PCFG in NLP
4. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology

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 probalistics 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 Indurkhya, N., &Damerau, F. J. CRC Press Taylor and Francis Group 2nd 2010.
2. Speech and Language Processing Martin, J. H., & Jurafsky, D. Pearson Education India 2nd 2013.
3. Foundations of Statistical Natural Language Processing Manning, Christopher 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) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Agile Project Management
Course Code: MET-405
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.

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, The 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: What makes an effective Scrum 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, The evolution of Agile- Agile project management opportunities Case study: Forming a value-driven task force, Product roadmaps: Benefits, pitfalls, and best practices, responding to change over following a plan. Activity Exemplar: 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. stermiller
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

M. Sc. (Computer Science) (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Research Project
Course Code: RP-406
Total Credits: 04
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.

- Student 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.

Scheme of Teaching

1. Each contact session for teaching or practical should be of 60 minutes each.
2. Minimum 45 periods should be conducted for each subject of 80 Marks.
3. One Practical Batch should be of 30 students.
4. Practical evaluation should be conducted before the commencement of University examination

Examination Pattern

Theory:

- **For 4 credit course-** University examinations: 80 marks, Internal evaluation: 20 marks
    - Two tests should be conducted of MCQ type questions. Each test will be of 10 marks
- **For 2 credit course-** University examinations: 40 marks, Internal evaluation: 10 marks
    - One test should be conducted of MCQ type questions of 10 marks.
- The internal marks will be communicated to the University at the end of each semester, but before the semester end examinations. These marks will be considered for the declaration of the results.

Practical:

Practical evaluation will be through university appointed panels of one external and one internal examiner.

On Job Training:

Student has to make a presentation of the work carried out during On Job Training in front of a panel external and internal examiners. He has to submit the report of work carried out as part of On Job Training.

Research Project:

- **For 4 credit course-** University examinations: 80 marks, Internal evaluation: 20 marks
    - Project viva by university appointed external and internal examiners.
    - Internal evaluation will be carried out by internal guide.
- **For 6 credit course-** University examinations: 100 marks, Internal evaluation: 50 marks
    - Project viva by university appointed external and internal examiners.
    - Internal evaluation will be carried out by internal guide.

Research Methodology:

- University examinations: 80 marks, Internal evaluation: 20 marks
    - Two tests should be conducted of MCQ type questions. Each test will be of 10marks

Nature of Question Paper and Scheme of Marking

Theory:

1) There will be seven (7) questions of 16 Marks and out of which four (4) to be attempted from question no 2 to 6.
2) Question No.1 is compulsory and is of multiple choice questions. There will be 8 multiple choice question each carries 2 marks
3) Question No.2 to Question No. 6 should consist 2 sub question each carries 8 marks
4) Question No. 7 should be a short note, where 4 questions will be given, out of which two questions should be attempted

Practical:

1) Duration of Practical Examination: 3 Hrs
2) Nature of Question paper: There will be three questions out of which any two questions to be attempted and each question carries 30 Marks.
3) The final practical examination will be conducted by the university appointed examiners both internal as well as external at the end of semester for each lab course and marks will be submitted to the university by the panel. The pattern of final Practical Examination will be as follows;

1	Coding and Execution of Program	60 Marks
2	Viva-voce	20 Marks
3	Journal	20 Marks
4	Total	100 Marks

The practical examination will be conducted semester wise in order to maintain the relevance of the respective theory course with laboratory course.

On Job Training:

Student has to make a presentation of the work carried out during On Job Training in front of panel external and internal examiners. He has to submit the report of work carried out as part of On Job Training.

Research Project:

- Student has to identify research problem in the third semester and have to carry out regress literature review.
- In the four semester student have to design a model and implement for the research problem identified in semester three.
- It is preferable to publish the research work carried out in the form of Conference /Research journal publications.

M. Sc. Part II (Semester III and IV)

Old Course				Equivalent Course		
Sem No.	**Course Code**	**Title of Old Course**	**Credit**	**Course Code**	**Title of New Course**	**Credit**
III	CC-301	Artificial Intelligence	4	MMT-202	Artificial Intelligence	4
III	CC-302	Advanced Web Technology	4	---	***No equivalence**	--
III	CC-303	PHP	4	MMT-301	Advanced PHP	4
III	CC-304.1	Software Quality Assurance	4	---	***No equivalence**	--
III	CC-304.2	Advance Data Science	4	MMT-302	**Data Science**	4
III	CC-304.3	Network Security Analyst	4	---	***No equivalence**	--
III	CC-304.4	Internet of Things	4	---	***No equivalence**	--

*** Two more chances be given to the student.**