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

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

NAAC A++ Grade with CGPA 3.52

Multiple Entry and Multiple Exit Option (NEP-2020)

Syllabus for

Master of Computer Application

(Under Faculty of Science and Technology)

PART-II SEMESTER- III & IV

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

M.C.A. (Science) Part–II(Level-6.5)

Programme Structure

Structure in Accordance with National Education Policy–2020

With Multiple Entry and Multiple Exit Options

M.C.A.(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	
	MMT305	4	--	4	60	24	2	40	16	
Major Elective	MET-306	4	--	4	60	24	2	40	16	
	MET-306									
Total				22	330			220		
Semester-IV										
Major Mandatory	MMT-401-Industrial/ Research project	--	8	18	300	120		150	60	
Major Elective (Swayam)	MET-402	4	--	4	60	24	2	40	16	
	MET-403									
Total				22	360			190		
Total(Sem III+ Sem VI)				44						

- MMT–Major Mandatory Theory
- MMPR–Major Mandatory Practical
- MET–Major Elective Theory
- MEPR–Major Elective Practical
- RP-Research Project

- Total Marks for MCA..-II :**1100**
- Total Credits for M.C.A.-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

- **Requirement for Exit after Level 6.5: Students can exit after completion of Level 6.5 with Master of Computer Application**

Course Codes

M.C.A. Semester-III		
	Major Mandatory	
MMT-301	Mobile Application Development (4 credits)	**MSU0325MML929I1**
MMT-302	Back End Development (4 credits)	**MSU0325MML929I2**
MMPR-303	Practical-III(4credits)	**MSU0325MMP929I1**
MMT-304	Advanced Python Programming(2 credits)	**MSU0325MML929I3**
MMT-305	Machine Learning (4 credits)	**MSU0325RP929I**
	Major Elective	
MET-305	Cloud Computing(4 credits)	**MSU0325MEL929I1**
MET-306	Data Science(4 credits)	**MSU0325MEL929I2**
M.C.A. Semester-IV		
MMT-401	Industrial Project /Research Project(18 credits)	**MSU0325MML929J1**
	Major Elective	
MET-402	NPTEL,SWAYAM Course(4 credits)	**MSU0325MEL929J1**
MET-403	NPTEL,SWAYAM Course(4 credits)	**MSU0325MEL929J2**

Master of Computer Application (MCA) Part II Semester III

Course Code: MMT-301

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. Jillur Rahman , Technical Publications,
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, Pravin Kumar , Technical Publications, 2025

Master of Computer Application (MCA) Part II Semester III

Course Code: MMT-302

Title of Course: Back End 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. Understand and explain the fundamentals of backend development
2. Set up and manage a local backend development environment by configuring servers
3. Develop backend applications using the MVC architecture by implementing RESTful APIs
4. Design and manage relational databases by writing optimized SQL queries
5. Implement secure and scalable backend features such as JWT-based authentication
6. Test, validate, and debug backend APIs by applying server-side input validation

UNIT I **(15 Hours)**

Introduction to backend, Server, Client & Database, backend frameworks, MVC / MVT Architecture Overview, Folder Structure in Different Stacks, Routing, Controllers, and Middleware, Templating Engines (Blade, Django Templates, EJS), Setting Up Local Development Environment, Git and GitHub Basics, Environment Variables using .env Files

UNIT II **(15 Hours)**

Setting up Express.js in MVC Format, Using Sequelize ORM with SQL Database, Building RESTful API Endpoints, JWT Authentication with Role-Based Access, File Uploads with Multer, Custom Middleware and Error Handling

UNIT III **(15 Hours)**

Understanding Relational Databases, Writing SQL Queries: SELECT, JOIN, WHERE, GROUP BY, Creating Database Schemas, Migrations, and Relationships, Performing CRUD Operations using ORM, Seeding Data and Ensuring Data Integrity, Debugging SQL with Logs and Query Builders

UNIT IV **(15 Hours)**

Designing RESTful APIs for Applications Creating CRUD Routes with Server-Side Validation, Implementing JWT Token-Based Authentication, Protecting Routes with Authentication Middleware, Validating and Sanitizing Input Data, Testing APIs with Postman or Thunder Client, Sending Proper HTTP Status Codes and Error Response

References

1. RESTful API by Andrzej Jarzyna, Samir Amzani, Mike Amundsen
2. Modern REST API Development in Go by Jesús Espino, 2025 OReilly Publication
3. RESTful Web APIs: Services for a Changing World by Leonard Richardson, Mike Amundsen, 2013

Master of Computer Application (MCA) Part II Semester III

Course Code: MMPR-303
Title of Course: Practical-III

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) Design, implement, and manage relational databases by creating schemas, performing CRUD operations, and writing optimized SQL queries using real-world datasets in a laboratory environment.

2) Develop and test secure, scalable backend functionalities by implementing JWT-based authentication, role-based access control, and session management through practical lab exercises and mini-projects.
3) Build scalable, robust Python applications by implementing advanced Object-Oriented Programming (OOP) architectures—including inheritance, polymorphism, and abstract interfaces—while ensuring application stability through structured exception handling and error logging.
4) Design and execute data-driven Python scripts that interface seamlessly with a MySQL database management system to establish secure connections, execute queries, and manage persistent data.

Practical will be based on MMT-302 and MMT-304

Master of Computer Application (MCA) Part II Semester III

Course Code: MMT-304

Title of Course: Advanced Python Programming

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. Develop python programs by applying OOPs concepts- class, object, inheritance, encapsulation and polymorphism.
2. Develop modules and packages in python programs for modular programming approach.
3. Implement error handling techniques using exception handling.
4. Develop python programs to build database connectivity with MySql.

UNIT-I **(15 Hours)**

Procedure Oriented approach, features of OOPS, Classes and objects, Encapsulation, Abstraction, Inheritance. Defining class, Self variable, Types of variables, Constructor. Namespaces, Types of methods- Passing members of one class to another class, inner classes. Inheritance- Constructors in inheritance, Overriding super class constructors and methods, Super()method Types of inheritance, Method Resolution Order, Duck Typing philosophy of Python, Polymorphism, Method overloading.

UNIT-II **(15 Hours)**

Polymorphism, Method overloading, Operator overloading, Method overriding, Abstraction and Interfaces. Abstract methods and Abstract classes, Interfaces. Abstract classes vs interface, Exception Handling, Types of errors, Compile time errors, Runtime errors, Logical errors, Exceptions, Exception handling, Predefined exceptions, try, except and finally clauses, Raise, assert statements, logging exceptions. Installation of MySql, Creating Mysql database instanced, establishing connection with mysql, Executing SQL Queries.

Reference Books:

1. Python Object-Oriented Programming (4th Edition, 2021) by Steven F. Lott and Dusty Phillips.
2. Learning Python, Fourth Edition, Mark Lutz, O'Reilly publication
3. Practical Programming: An introduction to Computer Science Using Python, second edition, Paul ries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf
4. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, Sakis Kasampalis,Packt Publishing, 2019

Master of Computer Application (MCA) Part II Semester III

Course Code: MMT-305

Title of Course: Machine Learning

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 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 Géron 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. Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies / John D. Kelleher, Brian Mac Namee, and Aoife DArcy.
7. Supervised Machine Learning with Python: Develop rich Python coding practices while exploring supervised machine learning by Taylor Smith
8. Machine Learning Systems Principles and Practices of Engineering Artificially Intelligent Systems, Vijay Janapa Reddi

Master of Computer Application (MCA) Part II Semester III

Course Code: MET-306

Title of Course: Cloud Computing

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

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

1. Explain the evolution of computing paradigms
2. Describe the fundamental concepts of cloud computing
3. Apply virtualization concepts by identifying types of virtualization,
4. Demonstrate knowledge of cloud programming environments and distributed programming paradigms,
5. Analyze cloud access and management mechanisms, including authentication, authorization, accounting, provenance, metadata handling, reliability, fault tolerance, security, privacy, policy, compliance, federation, and interoperability standards.
6. Utilize AWS core and managed services

UNIT-I (**15 Hours**)

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds. Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage.

UNIT-II (**15 Hours**)

Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs Service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage, Network - Case studies. Platform as a Service (PaaS) - Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).

UNIT-III (**15 Hours**)

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment. Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy,

policy and compliance- Cloud federation, interoperability and standards

UNIT-IV (**15 Hours**)

Cloud Computing on AWS: Delve into AWS's core services - Compute, Load Balancing, Autoscaling, Storage, and more. Learn about AWS Organization and Identity, Networking, and Web Application Firewall to manage cloud resources and secure your applications. Managed Services on AWS: Explore AWS's managed services like Databases (RDS, DynamoDB), SNS, SQS, Cloudwatch, and more. Also, experience serverless computing with AWS Lambda and dive into AWS's cognitive services like Rekognition, Comprehend, and Polly.

References

1. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009
3. Cloud Computing by Lizhe Wang, Rajiv Ranjan, Jinjun Chen, Boualem Benatallah

Master of Computer Application (MCA) Part II Semester III
Course Code: MET-306
Title of Course: Data Science

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 what Data Science is, why companies need it, and the different jobs a data scientist does every day.
2. Use super-fast Python tools (Polars, Dask) to handle huge datasets that Pandas can't manage without crashing.
3. Calculate averages, spreads, and relationships in data (mean, stddev, correlation) to summarize any dataset quickly.
4. Create beautiful charts and graphs (Matplotlib, Seaborn) to explore data patterns, correlations, and hidden insights.
5. Understand the concept of Exploratory Data Analysis (EDA) and to learn automated EDA tools and frameworks.

UNIT I **(15 Hours)**

Introduction to Data Science: Meaning of data science, importance in modern industry, role of data scientist, real world applications, data driven decision-making. Data and Process Understanding: Types and sources of data – structured, semi-structured, unstructured, steps in data science process, working with Python scripts with Google Colab. Introduction to Python Libraries

UNIT II **(15 Hours)**

Introduction to Big Data: Introduction to Big Data concepts, Hadoop ecosystem, Spark basics, advanced distributed computing using Spark and integration with NoSQL ecosystems (MongoDB/Cassandra), Advanced high-performance libraries such as Polars and Dask for large-scale data manipulation and visualization.

UNIT III **(15 Hours)**

Statistical Foundation: Definition and scope of statistics in data science, data types – categorical, ordinal, numerical, continuous, nominal variables. Descriptive Statistics: Measures of central tendency – mean, median, mode, measures of dispersion – variance, standard deviation, range, covariance. Data Visualization and Distribution: Using histograms,

boxplots, and scatterplots to visualize data patterns.

UNIT IV **(15 Hours)**

Data Preprocessing: Need for data cleaning, handling missing values using imputation or deletion, managing duplicates, data consistency checks. Data Transformation: Scaling techniques .**Exploratory Data Analysis:** 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.

References:

1. Python for Data Analysis (4th Edition) – Wes McKinney, O'Reilly Media, 2025.
2. Practical Statistics for Data Scientists (3rd Edition) – Peter Bruce & Andrew Bruce, O'Reilly Media, 2025.
3. Hands-On Machine Learning with Scikit-Learn and TensorFlow (3rd Edition) – AurélienGéron, O'Reilly Media, 2025.
4. Data Science from Scratch (2nd Edition) – Joel Grus, O'Reilly Media, 2025.

Master of Computer Application (MCA) Part II Semester IV
Course Code: MMT-401
Title of Course: Industrial Project / Research Project

Internal Marks: 150 External Marks: 300 Practical: 08 hours/week

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

1. Identify suitable Application or Research problem to carry out project work.
2. Apply critical thinking skills and research skills to address selected problem statement.
3. Learn to work in a team and explore experiential learning
4. Prepare report of research findings/ industry work in written forms.

At the end of the fourth semester of study, a student will be examined in the course" Industrial/ Research project".

1. Project work may be done individually or in groups in case of bigger projects. However, if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to see the progress of individual modules is independent of others. Students should take guidance from an internal guide and prepare a Project Report on "Industrial/ Research project" in 2 copies to be submitted to the Head of the Institute.
2. The Project Report should contain an Introduction to Project, which should clearly explain the project scope in detail. Along with Database designs and a list of output reports should be included.
3. The project Work should be of such a nature that it could prove useful or should be relevant from the commercial/management/research angle.
4. The project report will be duly accessed by the internal guide of the subject and internal marks will be communicated by the Head of the Institute to the University.
5. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.
6. The major project work carries 150 marks for internal assessment and 300 marks for external viva. The external viva shall be conducted by a panel of minimum of three examiners out of which one will be the Chairman of the panel.
7. Project work can be carried out in the Institute or outside with prior permission of the Institute.
8. Project viva-voce by the University panel will be conducted after completion of training.

Master of Computer Application (MCA) Part II Semester IV

Course Code: MET-402/ MET-403

Title of Course: NPTEL, SWAYAM Course

Internal Marks: 40 **External Marks: 60** **Theory: SWAYAM course**

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

For MET-402 / MET-403: ONE of the available NPTEL, Swayam Courses will be selected in November/December for Registration on the NPTEL Portal. The Swayam Coordinator of the Department will select/finalize the suitable courses and will initiate the registration process on the NPTEL portal in November/December of the Academic Year. As suggested in NEP-2020.