DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/PG/College./NEP/19/2024

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/ Ad-hoc Boards & recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted** the following Syllabi under the Faculty of Science & Technology **as per Norms of National Education Policy -2020** run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1.	M.Sc.Microbiology	IIIrd & IVth semester
2.	M.Sc.Botany	IIIrd & IVth semester
3.	M.Sc.Environmental Science	IIIrd & IVth semester
4.	M.Sc.Industrial Chemistry	IIIrd & IVth semester
5.	M.Sc.Biochemistry	IIIrd & IVth semester
6.	M.Sc.Chemistry Specialization Analytical Chemistry,Organic Chemistry, Inorganic Chemistry,Polymer Chemistry, Industrial Chemistry.	IIIrd & IVth semester
7.	MCA(Science)	IIIrd & IVth semester
8.	M.Sc (Forensic Science)	Ist to IVth semester
9.	M.Sc.Forensic Cyber	Ist to IVth semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar.
431 004.
REF.NO.SU/2024/2446-54
Date:- 21.06.2024

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[M.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR

FACULTY OF SCIENCE & TECHNOLOGY

Post-Graduate 2Years/1Year P.G. Programme in Science (MCA)

As per National Education Policy-2020

(To be implemented from Academic Year -2024-25)

Course Structure and Curriculum

(Outcome Based Credit System)

Subject: - MCA (Science)

Semester – III & IV

Course Structure

Course : MCA (Science)
Duration : 2 Years – (Four Semesters)

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
AS PER National Education Policy (NEP) 2020

1. Structure. Two Year Post-Graduate Program MCA (Science)Faculty of Science & Technology

Year /level	Sem.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3(4) +2=14	4	4			22	PG Diploma (after 3 years degree)
	II	3(4) +2=14	4		4 Complete during summer break		22	
Cum. Cr. ForPG Diploma		28	08	4	4		44	
Exit option with Post-graduate Diploma (44 credits) after first year or two semester with completion ofcourses equivalent to 44 credits								
Second Year 6.5	III	3(4)+2=14	4			4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3(4)=12	4			6	22	
Cum. Cr. For1 year PG Degree		26	8			10	44	
Cum. Cr. For2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three year UG Degree or 1 Year-2 sem. PG Degree (44 credits) after four year UG degree								

ABBREVIATION:

Major: A course, which should compulsorily be studied by the student as requirement of core or majorsubject is termed as a core course.

DSE: Generally, a course which can be chosen from a pool of course and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidates proficiency/skill is called as elective course.

OJT: On-the- Job Training
FP: Field Project/Internship/Apprenticeship (Corresponding to the Major (Core) Subject
RP:-Research Project Corresponding to the Major (Core) Subject

Note- Master Programme is based on DSC Specialization

Course and Credit distribution structure for Two year Programme with Multiple Entry and Exit options
Discipline Specific Core in MCA (science)

MCA (Ist Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/500	Mathematical foundation for data science	2	-	2	-	2+2+2+2+ 2+2+2=14
			-	4	-	2	
	MCA/MJ/501	RDBMS	2	-	2	-	
			-	4	-	2	
	MCA/MJ/502	Operating System	2	-	2	-	
			-	4	-	2	
	MCA/MJ/503	Activity-1/Programming 1#	-	4	-	2	
	MCA/MJ/504	Practical based on Mathematical foundation for data science					
	MCA/MJ/505	Practical based on RDBMS					
	MCA/MJ/506	Practical based on Operating System					
	MCA/MJ/507	Practical Based on Programming 1					
DSE (Choose any one from pool of courses)	MCA/DSE/ 520-522	Elective-1#	2	-	2	-	2+2= 04
	MCA/DSE/ 523-525	Practical Based on Elective-1#	-	4	-	2	
RM	MCA/RM/530	**RM-1**	4	-	4	-	04
			12	20	12	10	22 credits

Programming group (Elective 1#) (#Choose any one from Pool /Basket)

Programming Group	Course Code	Activity/Programming- 1
Java Group	MCA/MJ/503/1	Core Java
Microsoft Group	MCA/MJ/503/2	Advanced C++
Open Group	MCA/MJ/503/3	Python

DSC (Elective-I): (#Choose any one from Pool /Basket)

Elective Group	Course Code	Elective 1
Data Science	MCA/DSE/521	Data mining
Security	MCA/DSE/522	Network Security
Pattern Analysis & Machine Intelligence	MCA/DSE/523	Digital Image Processing

MCA (IInd Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/550	Data structure	2	-	2	-	2+2+2+2+ 2+2+2=14
			-	4	-	2	
	MCA/MJ/551	Software Engineering	2	-	2	-	
			-	4	-	2	
	MCA/MJ/552	Computer Network	2	-	2	-	
			-	4	-	2	
	MCA/MJ/553	Activity-2 / Programming 2#	-	4	-	2	
	MCA/MJ/554	Practical based on Data structure					
	MCA/MJ/555	Practical based on Software Engineering					
	MCA/MJ/556	Practical based on Computer Network					
	MCA/MJ/557	Practical based on Activity-2 / Programming 2					
DSE (Choose any one from pool of courses)	MCA/DSE/ 558-560	Domain Specific Elective-2#	2	-	2	-	2+2= 04
	MCA/DSE/ 561-563	Practical based on Elective 2#	-	4	-	2	
OJT/FP	MCA/DCE/570	OJT/FP	-	4	-	4	04
			08	24	08	14	22 credits

Activity / Programming Group (#Choose any one from Pool /Basket)

Programming Group	Course Code	Activity/Programming-2
Java Group	MCA/MJ/553/1	Advance Java
Microsoft Group	MCA/MJ/553/2	VB.NET
Open Group	MCA/MJ/553/3	Advanced Python

Elective Group (#Choose any one from Pool /Basket)

Elective Group	Course Code	Elective 2
Data Science	MCA/DSE/558	Machine learning
Security	MCA/DSE/559	Cyber Security
Pattern Analysis & Machine Intelligence	MCA/DSE/560	Pattern recognition

MCA (IIIrd Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/600	Design and analysis of algorithm	2	-	2	-	2+2+2+2+ 2+2+2=14
			-	4	-	2	
	MCA/MJ/601	Artificial Intelligence	2	-	2	-	
			-	4	-	2	
	MCA/MJ/602	Principles of Data Science	2	-	2	-	
			-	4	-	2	
	MCA/MJ/603	Activity-3 / Programming 3 #	-	4	-	2	
	MCA/MJ/604	Practical based on Design and analysis of algorithm					
	MCA/MJ/605	Practical based on Artificial Intelligence					
	MCA/MJ/606	Practical based on Principles of Data Science					
	MCA/MJ/607	Practical based on Activity-3 / Programming 3 #					
DSE (Choose any one from pool of courses)	MCA/DSE/ 608-610	DoElective-3#	2	-	2	-	2+2= 04
	MCA/DSE/ 611-613	Practical based on Elective - 3	-	4	-	2	
RP-1	MCA/RM/605	**RP-1**	-	8	-	4	04
			08	28	08	14	22 credits

Activity/Programming Group (#Choose any one from Pool /Basket)

Programming Group	Course Code	Activity/Programming -3
Java Group	MCA/MJ/603/1	Android
Microsoft Group	MCA/MJ/603/2	C# NET
Open Group	MCA/MJ/603/3	Open Web Programming (PHP)

Elective Group (#Choose any one from Pool /Basket)

Elective Group	Course Code	Elective 3
Data Science	MCA/DSE/608	data warehousing
Security	MCA/DSE/609	Cyber Forensic
Pattern Analysis & Machine Intelligence	MCA/DSE/610	Computer Vision

MCA (IVth Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/650	Web Technology	2	-	2	-	2+2+2+2+2+2=12
			-	4	-	2	
	MCA/MJ/651	Exploratory data Analysis	2	-	2	-	
			-	4	-	2	
	MCA/MJ/652	Decision support System	2	-	2	-	
			-	4	-	2	
	MCA/MJ/653	Practical on Web Technology					
	MCA/MJ/654	Practical on Exploratory data Analysis					
	MCA/MJ/655	Practical on Decision support system					
DSE (Choose any one from pool of courses)	MCA/DSE/656 -658	Elective-4#	2	-	2	-	2+2= 04
		Practical based on Elective-4	-	4	-	2	
RP-2	MCA/RM/670	**RP-2**	-	12	-	6	06
			08	28	08	14	22 credits

Elective Group

Elective Group	Course Code	Elective 4
Data Science	MCA/DSE/656	Big data analytic
Security	MCA/DSE/657	Cryptography & Block chain
Pattern Analysis & Machine Intelligence	MCA/DSE/658	Open CV

Note: *,# Student is advised to select the any one course from the pool of courses, however horizontal selection of courses to be followed at the time of selection of the course.

OJT/FP: On Job Training / Field Project:

The Students are advised to select the On Job Training / Field Project in any one course from the pool of courses; however the objective is to get an idea about project development in various areas of real life Applications. The training will be for Software project understanding, problem analysis, requirement gathering, requirement analysis, specification, design, coding and implementation in the form of mini and major projects.

MCA (Science)

III Semeser Syllabus Details

MCA (IIIrd Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/600	Design and analysis of algorithm	2	-	2	-	2+2+2+2+ 2+2+2=14
			-	4	-	2	
	MCA/MJ/601	Artificial Intelligence	2	-	2	-	
			-	4	-	2	
	MCA/MJ/602	Principles of Data Science	2	-	2	-	
			-	4	-	2	
	MCA/MJ/603	Activity-3 / Programming 3 #	-	4	-	2	
	MCA/MJ/604	Practical based on Design and analysis of algorithm					
	MCA/MJ/605	Practical based on Artificial Intelligence					
	MCA/MJ/606	Practical based on Principles of Data Science					
	MCA/MJ/607	Practical based on Activity-3 / Programming 3 #					
DSE (Choose any one from pool of courses)	MCA/DSE/ 608-610	DoElective-3#	2	-	2	-	2+2= 04
	MCA/DSE/ 611-613	Practical based on Elective - 3	-	4	-	2	
RP-1	MCA/RM/605	**RP-1**	-	8	-	4	04
			08	28	08	14	22 credits

Activity/Programming Group (#Choose any one from Pool /Basket)

Programming Group	Course Code	Activity/Programming -3
Java Group	MCA/MJ/603/1	Android
Microsoft Group	MCA/MJ/603/2	C# NET
Open Group	MCA/MJ/603/3	Open Web Programming (PHP)

Elective Group (#Choose any one from Pool /Basket)

Elective Group	Course Code	Elective 3
Data Science	MCA/DSE/608	data warehousing
Security	MCA/DSE/609	Cyber Forensic
Pattern Analysis & Machine Intelligence	MCA/DSE/610	Computer Vision

NEP Structure for Post Graduate Degree in MCA (Science)

1. Design and analysis of algorithm

COURSE OBJECTIVE

- Introduction to the study of Computer Algorithm
- Study and implement simple and complex data representation system.

Course Title	Design and analysis of algorithm	
Course Practical	Practical based Design and analysis of algorithm	
Course code	MCA/MJ/600	MCA/MJ/604
Number of Credit	2 Theory	2 Practical

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	16/40	24/60
Practical	4hrs/Week	8/20	12/30

Prerequisites:

- Student should know the conventions and significance of writing algorithm, its contribution towards writing effective algorithms
- Student should be aware with algorithm testing mechanism
- Student should be able to write algorithms as well as exposed with foundation of data structures.

Learning Outcomes:

- Student should know the conventions and significance of writing algorithm, its contribution towards writing effective algorithms
- Student should be aware with algorithm testing mechanism
- Student should be able to write algorithms as well as exposed with foundation of data structures.

Course Outline

Unit 1: Data structures: Elementary data structures – Stacks, Stacks and Recursion, Queues, Queue Types, , Linked List, Types of List, List Representations, Trees, Binary search Tree, Red black tree, Graphs, types of graphs, graph property & its representation using lists, Hash tables

Unit 2:

Role of Algorithm in computing, Growth of function & Asymptotic notations, recurrences, recursion tree method, random variables and randomized algorithms

Sorting and Order statistics: Heaps – maintaining, building heap, heap sort, priority queues, Quicksort – building quick sort, performance evaluation, analysis of quicksort, sorting in linear times – radix sort, bucket sort, lower bounds of sorting, order statistics – maximum and minimum, selection expected in linear time , selection expected in worst-case linear time

Unit 3:

Advance Design & Analysis Techniques – B-trees, Binomial heap, Fibonacci heap, Minimum spanning tree Dynamic Programming, greedy algorithms, amortized analysis,

Graph Algorithms: Elementary graph algorithms (BFS, DFS), Single source shortest path algorithm – Bellman Ford, Dijkstra algorithms, all pair shortest path – .Shortest path & Matrix multiplication, Floyd – Warshall algorithm, Maximum Flow networks – ford Fulkerson algorithm, String matching algorithms

Reference Book: 1. Introduction to Algorithms by Thomas Corman, PHI publications

E-Books: 1. Design & Analysis of computer Algorithms by Alfred Aho, John Hopcroft and Jeffery Ullman (Link)

2. Introduction to Algorithms by Thomas Corman et al (Link)

Lab Exercise:

- Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc.

2. Artificial Intelligence

COURSE OBJECTIVE

- Students should get expertise in the field of Artificial Intelligence.
- Implementation of concepts for innovative tools and products.

Course Title	Artificial Intelligence	
Course Practical	Practical based on Artificial Intelligence	
Course code	MCA/MJ/601	MCA/MJ/605
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Prerequisites:

To be admitted you must have knowledge of Computing Science/ Cognitive Science, basic programming, Data Structures and Algorithms, Application Programming in Python

Course Outline

Unit 1: Introduction: What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. **Intelligent Agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit 2: Problem-solving: Solving Problems by Searching: Problem Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Heuristic Functions.

Unit 3: Knowledge, reasoning, and planning: Logical Agents, Knowledge Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches.

Text Book

1. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Third Edition, Prentice Hall, ISBN0-13-080302-2

Web Links:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/syllabus/

3. Principles of Data Science

COURSE OBJECTIVE

- Students should get expertise in the field of Artificial Intelligence.
- Implementation of concepts for innovative tools and products.

Course Title	Principals of Data Science	
Course Practical	Practical based on Principals of Data Science	
Course code	MCA/MJ/602	MCA/MJ/606
Number of Credit	2 Theory	2 Practical

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	16/40	24/60
Practical	4hrs/Week	8/20	12/30

Prerequisites:

To be admitted you must have knowledge of Computing Science/ Cognitive Science, basic programming, Data Structures and Algorithms, Application Programming in Python

Course Outline

Unit 1 INTRODUCTION TO DATA SCIENCE

Definition – Basic Terminology- Data science Venn diagram- Types of Data- Structured versus Unstructured data- Quantitative versus Qualitative data- The Four Levels of Data- Five steps of Data Science- Data Science Process Overview –Data science classification-Data Science Algorithms- Business Intelligence and Data Science- Components of Data Science.

Unit 2 DATA PROCESS AND EXPLORATION

Introduction-Prior Knowledge-Data Preparation-Modeling-Applications-Objectives of Data Exploration-Datasets- Descriptive statistics- Data Visualization: Introduction- Types of Data visualization- Technologies for visualization - Various visualization techniques - The Five Cs of Data Visualization.

Unit 3 DATA MODELLING AND ANALYTICS

Data Science Methodology- Analytics for Data Science- Data Analytics Examples- Data Analytics Life Cycle- Data Discovery- Data preparation- Model Planning- Model Building Operationalization.

Unit 4 FEATURE SELECTION AND FORECASTING Introduction-Feature Selection: Classifying feature selection methods- Anomaly Detection: Introduction- Distance and Density based outlier detection-Local Outlier Factor- Time series Forecasting- Decomposition-Smoothing based methods-Regression based methods-Machine Learning methods.

Unit:5 DATA SCIENCE TOOLS AND APPLICATIONS

Introduction to Data Science Tools- SAS- APACHE FLINK –Big ML- Excel- Tableau- MatplotlibTensorFlow- Weka- Applications: Hands-on with Solving Data Problems-Introduction-Collecting and Analyzing Twitter Data- Collecting and Analyzing YouTube Data.

Text Books

1 Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, Fundamentals of Data Science, 1 st Edition, 2022

2 Daimi, Kevin, Ed. Hamid R. Arabnia, Principles of Data Science, Springer, 2020.

3 Vijay Kotu, Bala Deshpande, Data Science: Concepts and Practices, Morgan Kaufmann Publishers, Second edition, 2019

4 D J Patil, Hilary Mason, Mike Loukides, Ethics and Data Science, O' Reilly, 1st edition, 2018

5 Sinan Ozdemir, Principles of Data Science, Packt Publishing, December 2016

1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets, v2.1, Cambridge University Press, 2014.
2 Cielen, Davy, Arno DB Meysman, Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and more, using Python Tools, Manning Publications Co., 2016 Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1 https://onlinecourses.nptel.ac.in/noc19_cs60/preview
2 https://www.classcentral.com/course/swayam-python-for-data-science-14266
3 https://www.youtube.com/watch?v=7eMsa-ecJlA

Programming 3 : Android

COURSE OBJECTIVE

- Students should get expertise in the field of Android Programming.
- Implementation of concepts for innovative tools and products.

Course Title	Android	
Course Practical	Practical based on Android	
Course code	MCA/MJ/603	MCA/MJ/607
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Course Description:
This course is designed to provide a comprehensive understanding of Android programming, starting from the basics and progressing towards more advanced concepts. Students will learn the fundamentals of Android app development, including user interfaces, data storage, networking, and multimedia integration. The course will also incorporate case studies and practical examples to demonstrate real-world applications of Android programming. Students will gain hands-on experience by developing their own Android apps and exploring reference books to deepen their knowledge.

Prerequisite: • Basic knowledge of Java programming language • Familiarity with object-oriented programming concepts

Course Outline:
Unit 1: Introduction to Android Development - Overview of Android ecosystem, setting up development environment (Android Studio, SDK, emulators), Understanding the Android project structure, Introduction to Android components (activities, fragments, services). User Interface Development - Layouts and views, User input and event handling, working with menus and dialogues, Creating responsive and adaptive interfaces, Material Design principles and guidelines

Unit 2: Data Storage and Persistence - Using SQLite database, Content Providers and data sharing SharedPreferences for app preferences, Working with files and external storage, Introduction to cloud storage and synchronization (Firebase). Networking and Web Services - Making HTTP requests (HTTP libraries, RESTful APIs), Parsing JSON and XML data, Working with web sockets, Authentication and authorization mechanisms, Caching and offline capabilities

Unit 3: Multimedia Integration - Working with images, audio, and video, integrating camera and gallery functionalities, playing media files and streaming, Implementing notifications and push notifications, Locationbased services and maps integration, Testing and debugging Android applications.

Case Studies and Project Development

architecture and key features (Social Media Applications),

2. Implementing key components of case study apps, Applying best practices and optimization techniques,

Recommended Reference Books:

1. "Android Programming: The Big Nerd Ranch Guide" by Bill Phillips, Chris Stewart, and Kristin Marsicano
2. "Head First Android Development" by Dawn Griffiths and David Griffiths
3. "Android Studio 4.0 Development Essentials - Kotlin Edition" by Neil Smyth
4. "Android App Development for Dummies" by Michael Burton
5. "Professional Android 4 Application Development" by Reto Meier

Programming 3 : C# NET

COURSE OBJECTIVE

Students should get expertise in the field of C# NET

- Programming.
- Implementation of concepts for innovative tools and products.

Course Title	C# NET	
Course Practical	Practical based on C# NET	
Course code	MCA/MJ/603	MCA/MJ/607
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

B)C#. NET

Unit 1: DOTNET Framework: Introduction to DOTNET, DOT NET class framework, Common Language Runtime – Overview, Elements of .NET application, Memory Management, Garbage Collector - Faster

Memory allocation, Optimizations, Common Language Integration, Common type system, Reflection API, User and Program Interface

Unit 2: Introduction to C#: Language features, Variables and Expressions, type conversion, Flow Control, Functions, Delegates, Debugging and error handling, exception handling (System Defined and User Defined), Object Oriented Concepts, Defining classes, class members, Interfaces, properties, . Access modifiers, Implementation of class, interface and properties, Concept of hiding base class methods, Overriding, Event Handling, Collections, Comparisons and Conversions, Defining and using collections, Indexers, Iterators, Type comparison, Value Comparison, Overloading Conversion operators, as operator. Generics- Using generics, Defining Generics, generic Interfaces, Generic methods, Generic Delegate, Arrays – Single Dimensional, Multi Dimensional, Jagged Array, Implicitly typed Array

Unit 3: Window Programming: Window Controls, Common Controls, Container Controls, Menus and Toolbars, Printing, Dialogs, Deploying Window Application - Deployment Overview, Visual studio setup and Deployment project types, Microsoft windows installer architecture, Building the project : Installation

Unit 4: Database Programming using C#: Data Access, File System Data, XML, Databases and ADO.NET - Data Binding, Web Programming, Basic Web programming, Advanced Web programming, Web Services, Deployment Web applications,

Books

- Beginning Visual C#, Wrox Publication
- Professional Visual C#, Wrox Publication
- Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press Â© 2001, 403 pages

Web References

- https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/
- C# Guide https://docs.microsoft.com/en-us/dotnet/csharp/
- Web Application C# https://msdn.microsoft.com/en-IN/library/dd492132.aspx

Programming 3 : Open Web Programming

COURSE OBJECTIVE

Students should get expertise in the field of Web Programming

- Programming.
- Implementation of concepts for innovative tools and products.

Course Title	Open Web Programming	
Course Practical	Practical based on Open Web Programming	
Course code	MCA/MJ/603	MCA/MJ/607
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

C)Open Web Programming

Unit 1: Introduction to Web Programming: Introduction, Creating a Website, Web Page Example ,HTML Tags, Structural Elements, title Element, meta Element, HTML Attributes, body Elements: hr, p, br, div, Cascading Style Sheets Preview, History of HTML, HTML Governing Bodies, Differences Between Old HTML and HTML, How to Check Your HTML Code, Case Study: History of Electric Power.

Unit 2:Coding Standards, Block Elements, Text Elements, and Character References, Introduction, HTML Coding Conventions, Comments, HTML Elements Should Describe Web Page Content Accurately, Content Model Categories, Block Elements, blockquote Element, Whitespace Collapsing, pre Element, Phrasing Elements, Editing Elements, q and cite Elements, dfn, abbr, and time Elements, Code-Related Elements, br and wbr Elements, sub, sup , s , mark , and small Elements, strong, em, b, u, and i

Elements, span Element, Character References, Web Page with Character References and Phrasing Elements, Case Study: A Local Hydroelectric Power Plant.

Unit 3: Cascading Style Sheets (CSS): Introduction, CSS Overview, CSS Rules, Example with Type Selectors and the Universal Selector, CSS Syntax and Style, Class Selectors, ID Selectors, span and div Elements, Cascading, style Attribute, style Container, External CSS Files, CSS Properties, Color Properties, RGB Values for Color, Opacity Values for Color, HSL and HSLA Values for Color, Font Properties, line-height Property, Text Properties, Border Properties, Element Box, padding Property, margin Property, Case Study: Description of a Small City's Core Area

Text Book

- John Dean (2019), Web Programming with HTML5, CSS, and JavaScript, Jones & Bartlett Learning, LLC, an Ascend Learning Company, Burlington, MA 01803.

Elective Group : 1. Data Warehousing

COURSE OBJECTIVE

Students should get expertise in the field of Data warehousing.

- Implementation of concepts for innovative tools and

Course Title	Data Warehousing	
Course Practical	Practical based on Data Warehousing	
Course code	MCA/MJ/608	MCA/MJ/611
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Unit 1:

Introduction to Data Warehousing - Overview of data warehousing and its components, Data modelling: star schema, snowflake schema, ETL processes: extraction, transformation, and loading of data, Practical applications and case studies of data warehousing.

Unit-2

OLAP and Data Cube - Introduction to OLAP and its benefits, Data cube representation and operations, OLAP tools and techniques, Practical applications and case studies of OLAP.

Unit-3

Case Studies – a) Retail Market Basket Analysis: Analysing customer purchase patterns to identify associations between products for targeted marketing b) Customer Segmentation: Clustering customers based on demographic and behavioural data to tailor marketing campaigns c) Loan Default Prediction: Using classification techniques to predict the likelihood of loan default based on historical data.

Reference Books:

1. "Data Warehousing Fundamentals" by Paulraj Ponniah.
2. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy Ross.
3. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei.
4. "Python for Data Analysis" by Wes McKinney.

Elective Group : 2. Cyber forensic

COURSE OBJECTIVE

Students should get expertise in the field of Cyber forensic.

- Implementation of concepts for innovative tools and products.

Course Title	Cyber forensic	
Course Practical	Practical based on Cyber forensic	
Course code	MCA/MJ/609	MCA/MJ/612
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Course Description: This course is designed to provide students with a comprehensive understanding of the field of cyber forensics, including the tools and techniques used for investigating and analyzing digital evidence. The course will cover the fundamental concepts of cyber forensics, explore various forensic tools and methodologies, and present real world case studies to demonstrate the application of these tools in solving cybercrime investigations.

Prerequisites: • Basic knowledge of computer systems and networks • Familiarity with operating systems and file systems • Understanding of information security principles

Course Outline:

Unit 1: Introduction to Cyber Forensics - Understanding cyber forensics: scope and importance, Legal and ethical considerations in cyber investigations, Roles and responsibilities of a cyber forensic examiner. Digital Evidence and Forensic Processes, Types of digital evidence, Evidence acquisition and preservation, Forensic imaging and hashing, Chain of custody and documentation

Unit 2: Forensic Tools and Techniques - Forensic imaging tools (e.g., EnCase, FTK, Autopsy), File system analysis and recovery, Network forensics and log analysis, Memory forensics and analysis, Mobile and Cloud Forensics, Forensics for mobile devices (smartphones, tablets), Investigating cloud-based platforms and services, Extraction and analysis of mobile app data

Unit 3: Network Traffic Analysis - Packet capture and analysis, Intrusion detection and prevention systems, Network log analysis, Malware Analysis and Reverse Engineering - Introduction to malware analysis, Static and dynamic analysis techniques, Code decompilation and reverse engineering.

Case Studies and Practical Application –
a) Analyzing a cybercrime case from start to finish,
b) Examining digital evidence and conducting forensic analysis,
c) Reporting findings and presenting evidence in court Recommended Reference Books: "Digital Forensics and Cyber Crime: An Introduction" by Marjie T. Britz

Recommended Reference Books:

1. "Computer Forensics: Investigating Data and Image Files" by EC-Council "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics" by John Sammons
2. "File System Forensic Analysis" by Brian Carrier
3. "Malware Forensics: Investigating and Analyzing Malicious Code" by Cameron H. Malin, et al.
4. "Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems" by Chris Sanders

1. "Digital Forensics and Cyber Crime: An Introduction" by Marjie T. Britz
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6. "Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems" by Chris Sanders

Elective Group : 3. Computer Vision

COURSE OBJECTIVE

- Students should get expertise in the field of Computer Vision
- Implementation of concepts for innovative tools and products.

Course Title	Data Warehousing	
Course Practical	Practical based on Computer Vision	
Course code	MCA/MJ/610	MCA/MJ/613
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Computer Vision

Course Description: This introductory course on practical computer vision provides students with a comprehensive foundation in the fundamental concepts, techniques, and applications of computer vision. Through a combination of theoretical lectures, hands-on coding exercises, and real-world case studies, students will gain practical knowledge and skills in various aspects of computer vision. The course will cover essential topics such as image processing, feature extraction, object detection, image segmentation, and deep learning-based approaches. Additionally, students will explore case studies that demonstrate the practical applications of computer vision in diverse fields such as healthcare, autonomous vehicles, surveillance, and augmented reality.

Prerequisites:

- Basic knowledge of programming (preferably Python)
- Familiarity with linear algebra and calculus
- Understanding of machine learning concepts

Course Outline

Unit 1: Introduction to Computer Vision - Overview of computer vision and its applications, Image formation and representation, Color models and image enhancement techniques, Image filtering and noise removal. Feature Extraction and Descriptors - Image feature types: corners, edges, blobs, Keypoint detection and feature extraction algorithms (e.g., Harris corner detection, SIFT, SURF, Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP)), Feature descriptors and matching techniques (e.g., SIFT descriptors, RANSAC), Feature tracking and optical flow

Unit 2: Object Detection, Recognition, Tracking and Motion Analysis - Introduction to object detection and localization, Traditional methods for object detection (e.g., Viola-Jones algorithm), Introduction to deep learningbased object detection (e.g., Faster R-CNN, YOLO), Tracking techniques (Kalman filter, particle filter, etc.), Multi-object tracking and data association, Optical flow estimation (Lucas-Kanade, Horn-Schunck, etc.), Motion segmentation and tracking, Event-based vision and bio-inspired motion analysis. Image Segmentation - Image segmentation techniques (e.g., thresholding, region-based segmentation, graph cuts), Introduction to semantic

Unit 3: Deep Learning for Computer Vision - Introduction to convolutional neural networks (CNNs) for computer vision, Transfer learning and fine-tuning pre-trained CNN models, Training CNN models from scratch, Introduction to generative adversarial networks (GANs),

Case Studies and Applications –

a) Computer vision in healthcare: Medical image analysis, disease diagnosis,

b) Computer vision in autonomous vehicles: Object detection, lane detection,

c) Computer vision in surveillance: Activity recognition, anomaly detection,

d) Computer vision in augmented reality: Marker detection, object tracking

Recommended Reference Books:

1. "Computer Vision: Algorithms and Applications" by Richard Szeliski
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3. "Practical Python and OpenCV" by Adrian Rosebrock
4. "Mastering OpenCV 4 with Python" by Alberto Fernandez Villan

MCA (IVth Semester)

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one from pool of Major courses)	MCA/MJ/650	Web Technology	2	-	2	-	2+2+2+2+ 2+2=12
			-	4	-	2	
	MCA/MJ/651	Exploratory data Analysis	2	-	2	-	
			-	4	-	2	
	MCA/MJ/652	Decision support System	2	-	2	-	
			-	4	-	2	
	MCA/MJ/653	Practical on Web Technology					
	MCA/MJ/654	Practical on Exploratory data Analysis					
	MCA/MJ/655	Practical on Decision support system					
DSE (Choose any one from pool of courses)	MCA/DSE/656 -658	Elective-4#	2	-	2	-	2+2= 04
		Practical based on Elective-4	-	4	-	2	
RP-2	MCA/RM/670	**RP-2**	-	12	-	6	06
			08	28	08	14	22 credits

Elective Group

Elective Group	Course Code	Elective 4
Data Science	MCA/DSE/656	Big data analytic
Security	MCA/DSE/657	Cryptography & Block chain
Pattern Analysis & Machine Intelligence	MCA/DSE/658	Open CV

Note: *,# Student is advised to select the any one course from the pool of courses, however horizontal selection of courses to be followed at the time of selection of the course.

OJT/FP: On Job Training / Field Project:

The Students are advised to select the On Job Training / Field Project in any one course from the pool of courses; however the objective is to get an idea about project development in various areas of real life Applications. The training will be for Software project understanding, problem analysis, requirement gathering, requirement analysis, specification, design, coding and implementation in the form of mini and major projects.

1. **Web Technology**

COURSE OBJECTIVE

Students should get expertise in the field of Web Technology

- Implementation of concepts for innovative tools and products.

Course Title	Web Technology	
Course Practical	Practical based Web Technology	
Course code	MCA/MJ/610	MCA/MJ/613
Number of Credit	**2 Theory**	**2 Practical**

Course Details	**Total Contact Hours**	**Internal Exam Min/Max**	**External Exam Min/Max**
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Course Outline

Unit 1.

Introduction to WWW : Protocols and programs, secure connections, application and development tools, the web browser, What is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation, 4 13

Unit 2 Introduction to HTML : The development process, Html tags and simple HTML forms, web site structure Introduction to XHTML : XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser. 5 17

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2 5 17

Unit 3 Javascript : Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition 3 10

Advance script, Javascript and objects, Javascript own objects, the DOM and web browser environments, forms and validations DHTML : Combining HTML, CSS and Javascript, events and buttons, controlling your browser, Ajax: Introduction, advantages & disadvantages ,Purpose of it ,ajax based web application, alternatives of ajax 3 10

Unit 4 XML : Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT 3 10

PHP : Starting to script on server side, Arrays, function and forms, advance PHP Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

2. Exploratory data Analysis

COURSE OBJECTIVE

Students should get expertise in the field of Computer Vision

- Implementation of concepts for innovative tools and products.

Course Title	Exploratory Data Analysis	
Course Practical	Practical based Data Analysis	
Course code	MCA/MJ/651	MCA/MJ/654
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Course Outline

Exploratory Data Analysis (MCAS316)

Unit-I: The Fundamentals of EDA

Exploratory Data Analysis Fundamentals, the significance of EDA, making sense of data, Numerical data, Discrete data, Continuous data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA.

Line chart, Bar charts, Scatter plot, Bubble chart, Scatter plot using seaborn, Area plot and stacked plot, Pie chart, Table chart, Polar chart, Histogram, Lollipop chart, Choosing the best chart.

Unit-II: Data Transformation

Introduction, merging database-style data frames, concatenating along with an axis, merging on index, Reshaping and pivoting, Transformation techniques, performing data deduplication, replacing values, handling missing data, Renaming axis indexes, Discretization and binning, Outlier detection and filtering, String manipulation, Benefits of data transformation, Challenges.

Unit-III: Descriptive Statistics

Understanding statistics, Distribution function - Uniform distribution, Normal distribution, Exponential distribution, Binomial distribution, Cumulative distribution function, Descriptive statistics, measures of central tendency – Mean, Median, Mode. Measures of dispersion - Standard deviation, Variance, Skewness, Kurtosis, Calculating percentiles, Quartiles.

Unit-IV Grouping, Correlation and Time Series Analysis

Grouping Datasets - understanding groupby(), Groupby mechanics Data aggregation - Group-wise operations, Group-wise transformations. Correlation - Introducing correlation, Types of analysis - univariate analysis, bivariate analysis, multivariate analysis, discussing multivariate analysis using the Titanic dataset. Time Series Analysis- Understanding the time series dataset, Fundamentals of TSA, Univariate time series, Characteristics of time series data.

Unit-V: Hypothesis Testing and Regression

Hypothesis testing, Hypothesis testing principle, statsmodels library, Average reading time, Types of hypothesis testing, T-test, p-hacking, Understanding regression, Types of regression, Model Development and Evaluation, EDA on Wine Quality Data Analysis

Reference Book:

1. Suresh Kumar Mukhiya, Usman Ahmed "Hands-On Exploratory Data Analysis with Python", Packt Publishing – 2020
2. Roger D. Peng "Exploratory Data Analysis with R"
3. John W. Tukey "Exploratory Data Analysis" Pearson Publication
4. Allen B. Downey "Think Stats: Exploratory Data Analysis" 2nd Edition, O'reilly publication

Lab Exercise:

Practical based on Exploratory Data Analysis: At least two experiments should be carried out on each unit.

3. Decision Support System

COURSE OBJECTIVE

Students should get expertise in the field of Decision Support System.

- Implementation of concepts for innovative tools and products.

Course Title	Decision Support System	
Course Practical	Practical based Data Analysis	
Course code	MCA/MJ/652	MCA/MJ/655
Number of Credit	**2 Theory**	**2 Practical**

Course Details	Total Contact Hours	Internal Exam Min/Max	External Exam Min/Max
Theory	2hrs/Week	**16/40**	24/60
Practical	4hrs/Week	**8/20**	12/30

Course Outline

Decision Support System

Unit 1

Management Information System : Definitions – Basic Concepts, Applications of Information Technology. System & Design: Systems Development' Initiative Different Methodologies- Life Cycle & Prototype approach Detailed study on Life Cycle Design & implementation Case Study.

Unit 2

Managerial Decision Making, Decision making process problem solving techniques- how decisions are being supported, Features of various CBIS. Decision Support System An Overview: Relevance scope of DSS characteristic and capabilities of DSS, Components of DSS, Classification of DSS.

Unit 3

Database Management System: Sources of data – data file environment database environment – data models – relevance of relational data base design in DSS. Model Base Management system: Types of models function, time, certainty, uncertainty, risk, structure OR models, Simon's model in information system, unit 4

design simulation technique. Dialog generation management system: User interface – graphics menus – Forms DSS tools – DSS generators – specific DSS, Constructing a DSS: Steps in designing a DSS identification of decision, building of MBMS – building of DGMS, implementation.

Suggested Readings

1. Keen, Peter G.W.: Decision Support System an Organizational Perspective Addison-Wesley Pub.
2. Theierauff, Robert J. Decision Support System for-effective planning – Prentice Hall - 1982.
3. Krober, Donald W., and Hugh. J. Watson Computer Based information System New York, 1984
4. Davis L Michael W. A Management Approach – Macmillan Publishing Company, Prentice Hall, New Jersey, 1988.
5. Andrew P. Decision Support System Engineering, Sage, John Wiley & Sons, New York, 1991.

Elective Group

Elective Group	Course Code	Elective 4
Data Science	MCA/DSE/656	Big data analytic
Security	MCA/DSE/657	Cryptography & Block chain
Pattern Analysis & Machine Intelligence	MCA/DSE/658	Open CV

Note: *,# Student is advised to select the any one course from the pool of courses, however horizontal selection of courses to be followed at the time of selection of the course.

Elective Group: Big Data analytics

Pre- requisites : Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

UNIT I : INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.

UNIT II : HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III : 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.

Unit IV : Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

UNIT V : Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Text Books

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015. References
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
8. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
9. Pete Warden, "Big Data Glossary", O'Reily, 2011.
10. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
11. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
12. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Elective Group: Cryptography and Blockchain

Prerequisite:

Basicunderstandingofcomputerscienceconceptsandprogramming
Familiaritywithdatastructuresandalgorithms
Knowledgeofnetworkingandinternetprotocols

Unit 1: Introduction to Cryptography – Overview of cryptography and its historical significance. Symmetric andasymmetricencryptionalgorithms.HashfunctionsanddigitalsignaturesCryptographicprotocolsandapplications.CryptographicTechniquesandAlgorithms
Keymanagementanddistribution.PublickeyinfrastructurePKI).Cryptographicattacksandcountermeasures.Securecommunicationprotocols(SSL/TLS).

Unit2:IntroductiontoBlockchainTechnology
Evolutionofblockchainanditsapplications.Distributedledgertechnologyandconsensusmechanisms.Cryptocurrenciesandsmartcontracts.Blockchainplatformsandecosystems. Blockchain Security and Privacy: Blockchain vulnerabilities and attack vectors, Privacy andanonymity in blockchain. Tokenization and non-fungible tokens (NFTs). Securing blockchain networks andtransactions.

Unit 3: Future Trends and Challenges – Quantum cryptography and post-quantum encryption. Scalability andinteroperability in blockchain. Regulatory and legal considerations. Ethical implications of cryptography andblockchaintechnology.CaseStudiesinCryptographyandBlockchain: aReal-worldapplicationsofcryptography in finance, healthcare, and government sectors. b) Success stories and challenges of blockchainadoptioninindustriessuchassupplychainvoting,anddidentity management.

RecommendedReferenceBooks:

"Cryptography and Network Security: Principles and Practice" by William

Stallings"MasteringBitcoin:UnlockingDigitalCryptocurrencies"by AndreasM. Antonopoulos"BlockchainBasics:ANon-

TechnicalIntroductionin25Steps" byDanielDrescher

"BlockchainRevolution:HowtheTechnologyBehindBitcoinandOtherCryptocurrenciesIsChangingtheWorld"by
DonTapscottandAlexTapscott

"The Age of Cryptocurrency: How Bitcoin and Digital Money are Challenging the Global Economic Order" byPaulVigna andMichaelJ. Casey

"Cryptocurrency: How Bitcoin and Digital Money are Challenging the Global Economic Order" by Abraham K.White

Elective Group: Open CV

Unit-I

What Is OpenCV, Who Uses OpenCV?, What Is Computer Vision?, The Origin of OpenCV, Downloading and Installing OpenCV, Getting the Latest OpenCV via CVS, More OpenCV Documentation, OpenCV Structure and Content, Introduction to OpenCV, First Program—Display a Picture, Second Program—AVI Video, Moving Around, A Simple Transformation, A Not-So-Simple Transformation, Input from a Camera, Writing to an AVI File

Unit-2

OpenCV Primitive Data Types, CvMat Matrix Structure, IplImage Data Structure, Matrix and Image Operators , Drawing Things, Data Persistence, Integrated Performance Primitives, A Portable Graphics Toolkit, Creating a Window, Loading an Image, Displaying Images, Working with Video,2 Convert Image, Image Processing, Overview, Smoothing, Image Morphology, Flood Fill, Resize, Image Pyramids, Threshold

Unt-3

Image Transforms, Overview, Convolution, Gradients and Sobel Derivatives, Laplace , Canny, Hough Transforms, Remap, Stretch, Shrink, Warp, and Rotate, Cart To Polar and Polar To Cart 172 LogPolar 174 Discrete Fourier Transform (DFT) 177 Discrete Cosine Transform (DCT) 182 Integral Images 182 Distance Transform 185 Histogram Equalization 186 Exercises 190

Reference Books

1. Learning OpenCV by Gary Bradski and Adrian Kaehler, 2008, Editor: Mike Loukides Production Editor: Rachel Monaghan Production Services: Newgen Publishing and Data Services
2. **Learning OpenCV 4: Computer Vision with Python 3** ***Range*** *: Approximately ₹1,902.60 as an eBook on Kobo in India* ***Author:*** *Joseph Howse, Joe Minichino, and Prateek Joshi*

Research Project RP2:

For Industry Project / Internship –

All students will have to undergo for Industry Project/ Internship with an industrial, business, service organization or institute. The condition of successfully completing the program shall not be deemed to have been satisfied unless a student undergoes Industry Project/ Internship under the supervision of the institute in organization as approved by the institute from time to time. Each student will be required to submit the Industry Project/ Internship report to the institute for the work undertaken during this period.

Internal Evaluation–

Internal Evaluation for the In-plant Training Project will be of 50 marks that will be evaluated by the respective faculty / guide depending upon presentation /review /performance during project/ report writing/ fieldwork/seminars etc.

External Evaluation Scheme

Student has to present seminar/ viva-voce/ demonstration of project in front of External Examiner. External evaluation for the project will be considered for 80%Marks.

The project will be assessed by the external examiner and the guide separately on the basis of the following criteria tentatively.

- Innovativeldea15%
- Content 15%
- Preparation of Project Report30%
- Presentation/Viva-voce40%
- If student failed to complete the project within scheduled time, then he/she has to reappear and register freshly with new project topic after paying required fees for that semester.

General Clause

It may be noted that beside the above specified rules and regulations all the other rules and regulations in force and applicable to semester system in post-Graduate courses in Dr. Babasaheb Ambedkar Marathwada University will be applicableasamendedfromtimetotimebytheUniversity.Thestudentsshall abide by all such Rules and Regulations.