Master of Computer Applications
Semester–IV

Course Code	Course Title	L	T	P	Credits
MCA-202A	**Big Data and Pattern Recognition** (Pre-requisite: DBMS)	3	0	0	3
		CIE	**SEE**		**Total**
		40	60		100

Course Outcomes (COs): At the end of this course, students will be able to	
MCA-202A.1	Understand big data concepts, characteristics, different data types, and motivations for big data adoption.
MCA-202A.2	Use and implement big data technologies such as HDFS, MapReduce, YARN, HBase, Hive, Pig, and Mahout.
MCA-202A.3	Utilize quantitative and qualitative techniques to analyze patterns, feature extraction, and classification methods.
MCA-202A.4	Implement and analyze NoSQL databases by exploring various storage types and utilizing MongoDB for efficient big data management and retrieval.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MCA-202A.1	2	2	2	–	–	–	–	–
MCA-202A.2	2	2	2	2	–	–	–	2
MCA-202A.3	3	3	2	2	–	–	–	2
MCA-202A.4	3	3	3	3	3	2	2	2

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT – I **Contact Hours: 10**

Understanding Big Data

Concepts and Terminology, Big Data Characteristics, Different Types of Data, Identifying Data Characteristics, Business Motivations and Drivers for Big Data Adoption: Business Architecture, Business Process Management, Information and Communication Technology, Big Data Analytics Lifecycle, Enterprise Technologies and Big Data Business Intelligence, Industry examples of big data.

UNIT – II **Contact Hours: 12**

Data Governance for Big Data Analytics

Evolution of Data Governance, Big Data and Data Governance, Big Datasets, Big Data Oversight, Big Data Tools and Techniques: HDFS, Map Reduce, YARN, Zookeeper, HBase, HIVE, Pig, Mahout, Developing Big Data Applications, Stepwise Approach to Big Data Analysis, Big Data Failure: Failure is common, Failed Standards, Legalities.

UNIT – III **Contact Hours: 12**

Data Analysis and Pattern Recognition

Quantitative and Qualitative Analysis, Pattern Recognition Systems, Fundamental Problems in Pattern Recognition, Feature Extraction and Reduction, Paradigms, Pattern Recognition Approaches, Importance and Applications. Data Domain for Pattern Recognition. Pattern Recognition using Nearest Neighbour Classifier and Modeling an AND Gate Neural Nets.

UNIT – IV **Contact Hours: 11**

NoSQL database concepts

An Overview of NoSQL, Characteristics of NoSQL, NoSQL Storage Types, Introduction of NoSQL Products, MongoDB: Features, Architecture, and Use Cases, NoSQL Data Management for Big Data: Schema Less Models, Key-Value Stores, Document Stores, Tabular Stores, Object Data Stores, Graph databases, NoSQL Misconceptions, NoSQL over RDBMS.

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, *Big Data Fundamentals Concepts*, Drivers & Techniques Prentice Hall.
2. David Loshin, *Big Data Analytics from Strategic Planning to Enterprise Integration with Tools*, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, *Principles of Big Data Preparing, Sharing and Analyzing Complex Information*, Morgan Kaufmann.
4. GauravVaish, *Getting Started with NoSQL*, Packt Publishing.
5. Rajjan Shinghal, *Pattern Recognition Techniques and Applications*, Oxford Higher Education.

Reference Books:

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer.
2. Jay Liebowitz, *Big Data and Business Analytics*, Auerbach Publications, CRC press.
3. Pete Warden, *Big Data Glossary*, O'Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley Publications.

Course Code	Course Title	L	T	P	Credits
MCA-272A	Big Data and Pattern Recognition Lab (Pre-requisite: SQL, Python)	0	0	4	2
		CIE	SEE		Total
		50	50		100

Course Outcomes (COs): At the end of this course, students will be able to

MCA-272A.1	Understand Big Data Fundamentals
MCA-272A.2	Apply Big Data Processing Techniques Using Hadoop Ecosystem.
MCA-272A.3	Perform Data Operations Using HBase.
MCA-272A.4	Implement and Analyze NoSQL Databases Using MongoDB.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MCA-272A.1	2	2	2	–	–	–	–	2
MCA-272A.2	2	2	–	2	–	–	–	2
MCA-272A.3	3	2	2	2	–	–	–	2
MCA-272A.4	3	3	3	3	3	2	2	2

List of Experiments

No.	Experiment Detail
1.	Install and set up Hadoop in a single-node cluster.
2.	Perform basic HDFS commands such as file upload, retrieval, and directory creation.
3.	Implement a word count program using MapReduce.
4.	Hive: Create databases and tables
5.	Hive: Execute basic queries.
6.	Install and configure HBase.
7.	Perform Create operation on HBase tables.
8.	Perform Read operation on HBase tables.
9.	Perform Update operation on HBase tables.
10.	Perform Delete operation on HBase tables.
11.	Install and configure MongoDB.
12.	Perform Create operation in MangoDB.
13.	Perform Read operation in MangoDB.
14.	Perform Update operation in MangoDB.
15.	Perform Delete operation in MangoDB.

Text Books:

1. Thomas Erl, WajidKhattak and Paul Buhler, *Big Data Fundamentals Concepts*, Drivers & Techniques

Prentice Hall.
2. David Loshin, *Big Data Analytics from Strategic Planning to Enterprise Integration with Tools*, Techniques, NoSQL, and Graph Morgan Kaufmann.
3. Jules J. Berman, *Principles of Big Data Preparing, Sharing and Analyzing Complex Information*, Morgan Kaufmann.
4. GauravVaish, *Getting Started with NoSQL*, Packt Publishing.
5. Rajjan Shinghal, *Pattern Recognition Techniques and Applications*, Oxford Higher Education.

Reference Books:

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer.
2. Jay Liebowitz, *Big Data and Business Analytics*, Auerbach Publications, CRC press.
3. Pete Warden, *Big Data Glossary*, O'Reily.
4. Michael Mineli, Michele Chambers, AmbigaDhiraj, *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*, Wiley Publications.

Course Code	Course Title	L	T	P	Credits
MCA-204A	**Design and Analysis of Algorithms** (Pre-requisite: Advanced Data Structure using C++)	3	0	0	3
		CIE	SEE		Total
		40	60		100

Course Outcomes (COs): At the end of this course, students will be able to

MCA-204A.1	Understand and apply new algorithms.
MCA-204A.2	Analyse complexity of algorithms
MCA-204A.3	Understand various graph algorithms and their complexities.
MCA-204A.4	Understand the algorithms in terms of P and NP Class problems.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MCA-204A.1	3	2	3	3	-	–	–	3
MCA-204A.2	3	3	2	2	-	2	2	3
MCA-204A.3	3	3	3	-	-	–	–	3
MCA-204A.4	3	3	2	-	-	–	–	–

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT – I **Contact Hours: 11**

Space and Time Complexity, Notations, Sorting techniques and recurrence relation

Introduction: Algorithms, Performance Analysis: Space and Time Complexity, Asymptotic Notations, Big Oh, Omega, theta notations, finding complexity of the algorithm, Sorting: Insertion sort, Bubble sort, selection sort, count sort.

Recurrence relation and solution (substitution, recurrence tree and master method).

UNIT – II **Contact Hours: 10**

Dynamic Programming

General Method, Matrix chain multiplication, longest common subsequence, Greedy Method: General method, Activity Selection problem, Huffman Codes, job scheduling with deadlines, fractional knapsack problem.

UNIT – III **Contact Hours: 12**

Backtracking techniques and Graph Algorithms

Backtracking: Travelling Salesman Problem, Graph Colouring, n-Queen Problem.

Graph Algorithms: Traversal Methods (Depth- First and Breadth- First), Topological sort, strongly connected components, Minimum cost spanning tree: Kruskal's and Prim's, single source shortest path, All pair shortest path.

UNIT – IV **Contact Hours: 10**

Computational Complexity, Flow and Sorting Networks

Computational Complexity: Basic concepts, Polynomial vs Non-Polynomial Complexity.

Flow and Sorting Networks: Flow Networks, Ford-Fulkerson Method, Maximum Bipartite Matching, sorting network, comparison network, the zero-One Principle, Bitonic sorting network, Merging network

Text Books:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, *Introduction to Algorithms*, MIT Press, 3rd edition, 2010.
2. Ellis Horowitz, Satraj Sahni and Rajasekharam, *Fundamentals of Computer Algorithms*, Universities Press

Reference Books:

1. R.C.T. Lee, S.S. Tseng, R.C. Chang and T. Tsai, *Introduction to Design and Analysis of Algorithms A strategic approach*, McGraw-Hill Education
2. Aho, Ullman and Hopcroft , *Design and Analysis of algorithms*, Pearson Education
3. Anany Levitin, *Introduction to the Design and Analysis of Algorithm*‖, Pearson Education, 2nd edition

Course Code	Course Title	L	T	P	Credits
MCA-206A	**Intellectual Property Rights** (Pre-requisite: None)	2	0	0	2
		CIE	SEE		Total
		40	60		100

Course Outcomes (COs): At the end of this course, students will be able to

MCA-206A.1	Acquaint the learner with basic concepts of Intellectual Property Rights.
MCA-206A.2	Learn about patents and copyrights, and how to apply for the same.
MCA-206A.3	Learn about trademarks and design, and how to get them registered
MCA-206A.4	Sensitize the learner about emerging issues in IPR

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MCA-206A.1	3	-	-	-	-	-	2	2
MCA-206A.2	3	2	-	1	2	-	2	2
MCA-206A.3	3	-	-	-	2	-	2	2
MCA-206A.4	3	-	2	-	-	-	3	3

Instructions for Paper Setter: The examiner will set 9 questions asking two questions from each unit and one compulsory question. The compulsory question (Question No. 1) will consist at least 4 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question. All questions will carry equal marks.

UNIT – I — Contact Hours: 7

Introduction to Intellectual Property Rights

Meaning of property, Meaning of Intellectual Property Rights, Nature, Kinds of Intellectual property rights— Copy Right, Patent, Trademark, Trade Secret, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge, Introduction to TRIPS and WTO.

UNIT – II — Contact Hours: 8

Patents and Copy Rights

Patents: Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.

Copy Rights: Definition &Types of Copy Right, Registration procedure, Assignment & license, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.

UNIT – III — Contact Hours: 7

Trademarks and Design

Trademarks: Meaning & Nature of Trademarks, Types, Registration of Trademarks, Infringement & Remedies, Offences relating to Trademarks, Passing Off, Penalties.

Design: Meaning, Definition, Object, Registration of Design, Semiconductor Integrated circuits and layout design Act-2000.

UNIT – IV **Contact Hours: 8**

Emerging Issues

IPR and sustainable development. The Impact of Internet on IPR. E-Commerce and IPR issues, IT Act and amendments.

Cybercrime, Digital signature. Traditional knowledge and IPR, Bio piracy, Domain Names on cyber space, Domain Name Disputes, Cybersquatting.

Text Books:

1. Dr. G.B. Reddy, *Intellectual Property Rights and the Law*, Gogia Law Agency, 2020.
2. Dr. B.L. Wadehra, *Law relating to Intellectual Property*, Universal Law Publishing Company, 2011.
3. Nithyananda. K. V., *Intellectual Property Rights: Protection and Management*, Cengage learning, 2019

Reference Books:

1. P. Narayanan, *Intellectual Property Law*, Eastern Law House, 2020
2. T. Ramappa, *Intellectual Property Rights: Law in India,* Asia Law House, 2025

Course Code	Course Title	L	T	P	Credits
MCA-274A	**Project** (Pre-requisite: None)	0	0	20	10
		CIE	**SEE**		**Total**
		50	50		100

Course Outcomes (COs): At the end of this course, students will be able to	
MCA-274A(v).1	Examine and evaluate problems given by industry.
MCA-274A(v).2	Learn professional skills such as teamwork, communication, and project management in an industry setting.
MCA-274A(v).3	Employ industry-standard tools and technologies to successfully complete assigned tasks and projects.
MCA-274A(v).4	Develop comprehensive documentation summarizing project outcomes, and detailing the skills acquired during the internship.

Course Outcomes (CO) to Program Outcomes (PO) mapping (scale 1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
MCA-274A(v).1	2	2	-	–	–	1	–	–
MCA-274A(v).2	2	–	–	3	2	3	–	3
MCA-274A(v).3	3	3	3	3	2	2	-	2
MCA-274A(v).4	2	–	3	3	2	–	2	3

Guidelines for the Project:

A student shall be required to work on a Project in 4th semester of the programme. The Project work will be of required number of credits as per Scheme of Studies and Examinations.

1. Project shall be done by the students in-house during the assigned Lab periods in the respective semester.
2. Project shall be done by the students either individually or in a group of maximum three students.
3. All faculty members are eligible to be appointed as Project Guides/ Supervisors. The Head of the department shall allocate project guides based on the fields of projects & specializations of the teachers.
4. The Project topics & expected outcomes will be approved by the Departmental Committee comprising of Head of the Department or his nominee, a senior most teacher of the Department, departmental Coordinator of Projects and the concerned Project Guide.
5. The candidates are required to submit a comprehensive report (in the format and as per Guidelines issued) of the Project at the end. The viva-voce shall be held by one External and one Internal Examiner as per the examination schedule of the practicum course of the respective semesters.
6. SEE for the Project shall be conducted by a panel of two examiners (out of the panel recommended by the PGBoS), one of them shall be the Project Coordinator as the Internal Examiner, and the second to be appointed by the Director. Subject to the discretion of the Director, one of the examiners may be an examiner from outside the Institute.

The relative weightage of Project shall be as given in Table-1.

Table-1: Relative Weightages of Project

Component	Description of the Component		Relative Weightage (Out of 100)
CIE	i)	Project Synopsis Evaluation	10
	ii)	Mid-Term Project Evaluation	15
	iii)	Final Presentation and Project Evaluation	25
		CIE Total	**50**
SEE	Performance in Presentation and External Viva-voce		**50**
		Grand Total	**100**