DATTA MEGHE INSTITUTE OF MEDICAL SCIENCES

(DEEMED TO BE UNIVERSITY)

SAWANGI (MEGHE), WARDHA

DEPARTMENT OF FACULTY OF SCIENCE & TECHNOLOGY

COURSE CURRICULUM FOR

MASTER OF COMPUTER APPLICATION

MCA

UNDER

SCHOOL OF ALLIED SCIENCES

W.E.F. 2021-22

Contents

Addition, Deletion and Modification of contents are highlighted with different colour codes

1. Green for addition,

2. Yellow for modification,

3. Red for deletion ,

4. Blue for Contents relevant to Gender, Environment and Sustainability, Human Values, Health Determinants, Right to Health Issues, Emerging demographic changes and Professional Ethics in the curriculum.

1. PREAMBLE

Datta Meghe Institute of medical sciences undertakes important measures to enhance academic standards and quality in education including innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters. The university formulates various regulations and guidelines from time to time to improve the education system and maintain minimum standards and quality.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students.

2. ABOUT THE COURSE

The program revolves around the field of Computer and Computer Applications which is essentially about storing processing securing and managing information. Students will be trained to empower them with new and upcoming technologies and will learn how to analyze computer problems and system performance manage large amounts of data provide quality customer service and maintain a safe secure network system. This programme is useful to develop skills in network design, computational theory and computer systems programming

3. AIM

This course, Master in Computer Application, is designed and introduced by University to bridge the gap and produce employable graduate in Science & technology which will enable the industry to grow and the graduates to become successful in the field of Computer Application

Goals

- To enable a learner to pursue any area of knowledge domain depending upon his / her interest.
- To widen the horizon of learner's intellectual insight.
- Rigidity of present system does not allow pursuit of areas of interest as well as widening the educational horizon of the learner, and
- Provision of choice is an essential condition for broad-based learner's profile across areas of knowledge.

4. OBJECTIVES:

The objectives of the program are to -

1. Impart knowledge of computer and programming logic environment
2. Impart Knowledge for comprehensive training to postgraduate students to empower them with new and upcoming technologies
3. To equip students with the technical knowledge required for an computer professional to handle multi-tasking and multi-programming situations and to assess and develop applications with new technologies and programming.
4. Evaluate and compare cutting edge technologies and techniques and its application in the solution of common computer application based problems.
5. Develop the capacity to continuously learn and adapt to the changing technologies and organizational environments.

5. ELIGIBILITY CRITERIA:

The aspiring candidate should have

- Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree.
- OR Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the University). "

6. INTAKE CAPACITY-

60 candidates per year

7. TEACHING LEARNING METHODOLOGY –

- The modality of teaching for teaching learning modules will be in the form of didactic
- Lectures, self directed learning, seminars presentation Microteaching etc.

8. MEDIUM OF INSTRUCTION:

- English shall be the medium of instruction for all the subjects of study and for examination of the course.

9. ATTENDANCE:

A candidate has to secure minimum 80% attendance in overall with at least-

1. 75% attendance in theoretical
2. 80% in Skills training (practical) for qualifying to appear for the final examination

10. COURSE DURATION-

- The MCA Course is of 2 years duration, divided into 4 Semesters (2 semesters each year) including dissertation/Project/ Internship in 4^{th} semester.

11. EDUCATIONAL PROGRAM

A) Distribution of Course duration

First Semester– Foundation Course

Sl. No.	Course Titles
MCA101	Mathematical Logic Combination & Graph Theory
MCA102	Advanced Software Engineering
MCA103	UI Frameworks
MCA104	Front End Development & Programming
MCA105	Database Design Development
MCA106 (PR-1)	Front End Development & Programming Lab
MCA107 (PR-2)	Database Design Development Lab
MCA108	Business Communication

Second Semester

Sl. No.	Course Titles
MCA201	Applied Machine Learning
MCA202	Statistical Data Analytics with R
MCA203	Reinforcement Learning
	Develop Enterprise Application
MCA204	Deep Learning
	Application integration
MCA205	Software Testing and Quality Assurance
MCA206 (PR-1)	Machine Learning Lab
MCA207(PR-2)	R programming Lab
MCA208	Research Methodology with Writing Research Paper

Third Semester

Sl. No.	Course Titles
MCA301	AI Implementation Capstone

Fourth Semester

Sl. No.	Course Titles
MCA401	In plant Project Work and Seminar / Company Internship

B) Distribution of Hours and Credits

First Semester – Foundation Course

Course Code	Course Name	Lectures (L)	Tutorial (T)	Pra/Activity (P)	Credits
MCA101	Mathematical Logic Combination & Graph Theory	3	1	0	4
MCA102	Advanced Software Engineering	3	1	0	4
MCA103	UI Frameworks	3	1	0	4
MCA104	Front End Development & Programming	3	1	0	4
MCA105	Database Design Development	2	0	2	3
MCA106 (PR-1)	Front End Development & Programming Lab	0	0	4	2
MCA107 (PR-2)	Database Design Development Lab	0	0	4	2
MCA108	Business Communication	1	1	0	2
	Total	15	5	10	25

Second Semester

Course Code	Course Title	L	T	P	Credits
MCA201	Applied Machine Learning	3	1	0	4
MCA202	Statistical Data Analytics with R	3	1	0	4
MCA203	Reinforcement Learning Develop Enterprise Application	3	1	0	4
MCA204	Deep Learning Application integration	3	1	0	4
MCA205	Software Testing and Quality Assurance	2	0	2	3
MCA206 (PR-1)	Machine Learning Lab	0	0	4	2
MCA207(PR-2)	R programming Lab	0	0	4	2
MCA208	Research Methodology with Writing Research Paper	2	0	0	2

Third Semester

Course Code	Course Title	L	T	P	Credits
MCA301	AI Implementation Capstone	0	0	40	20
		0	0	40	20

Fourth Semester

Course Code	Course Title	L	T	P	Credits
MCA401	In plant Project Work and Seminar / Company Internship	0	0	46	23
		0	0	46	23

C) Distribution of teaching hours

First Semester							
Sl. No.	**Course Titles**	**Hours**			**Credits**		
		Theory	**Practical**	**Total**	**Theory**	**Practical**	**Total**
1	Mathematical Logic Combination & Graph Theory	60	0	60	4	0	4
2	Advanced Software Engineering	60	0	60	4	0	4
3	UI Frameworks	60	0	60	4	0	4
4	Front End Development & Programming	60	0	60	4	0	4
5	Database Design Development	30	15	45	2	1	3
6	Front End Development & Programming Lab	0	60	60	0	2	2
7	Database Design Development Lab	0	60	60	0	2	2
8	Business Communication	30	0	30	2	0	2
TOTAL		**300**	**135**	**435**	**20**	**5**	**25**

Second Semester							
Sl. No.	**Course Titles**	**Hours**			**Credits**		
		Theory	**Practical**	**Total**	**Theory**	**Practical**	**Total**
1	Applied Machine Learning	60	0	60	4	0	4
2	Statistical Data Analytics with R	60	0	60	4	0	4
3	Reinforcement Learning Develop Enterprise Application	60	0	60	4	0	4
4	Deep Learning Application integration	60	0	60	4	0	4
5	Software Testing and Quality Assurance	30	15	45	2	1	3
6	Machine Learning Lab	0	60	60	0	2	2

7	R programming Lab	0	60	60	0	2	2
8	Research Methodology with Writing Research Paper	30	0	30	2	0	2
TOTAL		**300**	**135**	**435**	**20**	**5**	**25**

Third Semester						
Course Titles	**Hours**			**Credits**		
	Theory	**Practical**	**Total**	**Theory**	**Practical**	**Total**
AI Implementation Capstone	-					20
Fourth Semester						
Course Titles	**Hours**			**Credits**		
	Theory	**Practical**	**Total**	**Theory**	**Practical**	**Total**
In plant Project Work and Seminar / Company Internship	-					23

Summary of the Program: MCA

Sr. No	Particulars	Total Courses	Total Credits	Total Marks
1	Core Courses	6	24	600
2	Ability Enhancement Compulsory Course (AECC)	2	4	200
3	Skill Enhancement Compulsory Course (SEC)	4	8	400
4	Generic Elective Course (GE)	2	6	200
5	Discipline Specific Electives	2	8	200
6	Capstone - AI Implementation	1	20	400
7	In plant Project Work and Seminar / Company Internship	1	23	400
	Total	**18**	**93**	**2400**

Total MCA Program Credits: 93

D) <u>Curriculum Design</u>

The Master of Computer Application Program is organized into 4 teaching Semesters Minimum 180 working days will be available for teaching, learning and evaluation (TLE) in each year of study and 90 working days shall be available for each semester.

One Credit will be awarded to 1 contact hour of teaching and learning for Theory and one Credit will be awarded to 2 contact hours of teaching and learning for Practical and Studentship. For elective courses 2 contact hours shall be awarded one credit.

E) Program Outcomes of MCA

PO1) **Computational knowledge**: Acquire knowledge of Computing Fundamentals, Basic Mathematics, Computing Specialization and Domain Knowledge of proper computing models from defined problems.

PO2) **Problem analysis**: Identify, formulate review research literate and analyze complex engineering problems reading substantiated conclusions using first principles mathematics, computing science and relevant domains.

PO3) **Design/development of solutions**: Ability to design system s/w or process as per global needs and specifications.

PO4) **Conduct investigations of complex computing problems**: Use research-based knowledge and research methods including design of experiments, analysis & interpretation of data & synthesis of information to provide valid conclusions.

PO5) **Modern Tool Usage**: Ability to demonstrate skills to use modern s/w & h/w tools to analyze problems.

PO6) **Professional Ethics**: Apply ethical principles and commit to professional ethics and cyber regulations.

PO7**)** **Life-Long Learning**: Ability to develop confidence for self-education and life-long learning in the global context of technological change.

PO8) **Project management and finance**: Ability to demonstrate knowledge & understanding of the engineering and management principles and apply them as a member & as a leader in a global team to manage multidisciplinary projects.

PO9) **Communication Efficacy**: Ability to communicate effectively in both verbal and written form.

PO10) **Societal and Environmental Concern**: Ability to understand the impact of IT solutions in a global and societal context.

PO11**)** **Individual and Team Work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12) **Innovations and entrepreneurship**: Find out right opportunity for entrepreneurship and create odd value for the betterment of an individual and society at global level.

Details of Syllabus

Master of Computer Applications (MCA): SEMESTER I

Course: Mathematical Logic, Combinatorics and Graph Theory	Course Code: MCA 101

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives:

No.	Course Objective
CO1:	To understand problems of mathematical logic using truth tables
CO2:	To solve various forms of disjunction and conjunction.
CO3:	To test the counting techniques in problems of permutations and combinations
CO4:	To develop the representations using Boolean algebra
CO5:	To formulate graphs and trees as per the given problem.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Mathematical Logic:	Introduction, Conjunction, Disjunction & negation, Propositions and truth table, Tautologies and contradictions. Equivalence of formulas, Duality law	12
2	Predicate Logic:	Disjunctive Normal form, Conjunctive Normal form, Predicate Calculus: Predicates, the statement function. Variables and quantifiers, predicate formulas, Methods of proof (Inference Theory).	12
3	Combinatorics:	Introduction to basic counting principles, Sum rule Principle, Product rule principle, Factorial Notation, Binomial Coefficients, Permutations, Permutations with repetitions, Combinations, The pigeon hole principle.	12
4	Boolean Algebra:	Introduction, Some Useful Operations, Definition of Boolean Algebra, Basic Theorems of Boolean Algebra, Duality in a Boolean Algebra, Definition of Boolean Functions, Application of Boolean Algebra.	12
5	Graph Theory:	Introduction, Basic Terminology, Some Special Simple Graphs, Representation of Graph, Graph Isomorphism, Connectivity of a Graph, Eulerian and Hamiltonian Graph, Trees and its Different Properties	12

	Total No. of Hrs	60

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-		-	-	-	-	-	-		-
CO2	2	2	-	2	-	-	-	-	-	-		-
CO3	3	3	-	2	-	-	2	-	-	-	2	-
CO4	3	3	-	2	-	-	-	-	-	-	2	-
CO5	3	3	-	2	-	-	2	2	-	-	2	-
Co Average	2.80	2.80	-	2.00	-	-	2.00	2.00	-	-	2.00	-

Course Outcomes: After completing the course, students will be able to

No.	Course Outcome
CO1:	Explain problems of mathematical logic using truth tables.
CO2:	Solve various forms of disjunction and conjunction.
CO3:	Test the counting techniques in problems of permutations and combinations.
CO4:	Develop the representations using Boolean algebra.
CO5:	Formulate graphs and trees as per the given problem.

Recommended Resources	
Text Books	1.Semyour Lipschutz, Marc Lipson: Discrete Mathematics, Tata McGraw-Hill Publishing Company Limited. 2. Sengadir, T.: Discrete Mathematics and Combinatorics, Pearson Education. 3.Kolman, Busby, Ross: Discrete Mathematical Structure, Pearson Education, 5th Edition.
Reference Books	1. Kenneth, H. Rosen: Discrete Mathematics and Its Applications, Mc GRAW Hill, International Edition. 2. Deo, N.: Graph Theory with Applications to Engineering and Computer Science, PHI. 3. Clark, John &Hetlan: A First Look at Graph Theory, Allied Publishers Limited.

Course: Advanced Software Engineering	Course Code: MCA 102

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim-MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To provide an advanced understanding and knowledge of the software engineering techniques.
2	To provide techniques to collect software requirements from client.
3	To provide CASE tools.
4	To understand the importance of these case tools in software development.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Life Cycle Models:	Waterfall Model, Prototying Models, Incremental Development, Spiral Model, Rapid Application Development, Componant Model, Agile Software Development, Selection of appropriate development process	12
2	Formal Methods:	Basic concepts, Mathematical Preliminaries, Mathematical notations for Formal Specification, Formal Specification Languages, Z-Notations, Ten commandments of formal methods, Formal Methods-The Road Ahead	12
3	Component-Based Software Engineering:	Component-Based Software Engineering: Engineering of Component-based Systems, CBSE Process, Domain Engineering, Component-based Development, Classifying and Retrieving Components, Economics of CBSE Cleanroom Software Engineering, The Cleanroom Approach, Functional Specification, Cleanroom Design Cleanroom Testing.	12
4	Client/Server Software Engineering:	Client/Server Software Engineering, The Structure of Client/Server Systems, Software Engineering for Client Server Systems, Analysis Modeling Issues, Design for Client Server Systems, Testing Issues. Web Engineering. The Attributes of Web-based Applications, WebE Process, Framework for WebE, Formulating/Analyzing Web-based Systems, Design for Web-based Applications, Testing Web-based Applications, Management Issues. Service Oriented Software Engineering, Services as Reusable Components, Service Engineering, and Software Development with Services.	12
5		Business Process Reengineering, Software Reengineering, Reverse Reengineering, Restructuring, Forward Reengineering,	12

	Reengineering and CASE:	Economics of Reengineering, Introduction, Building Blocks for CASE, Taxonomy of CASE Tools, Integrated CASE Environments, Integration Architecture, CASE Repository, Case Study of Tools like TCS Robot.	
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Explain different techniques of software engineering.
CO2	Identify the importance of the software development process.
CO3	Implement software design, coding and CASE tools.
CO4	Examine the knowledge of software project management from initial stage to final stage for software development.
CO5	Design and develop correct and robust software products using advanced software engineering techniques used globally.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2			-	-	-	-	-	-	-	-	-
CO2	3	2	2			2						
CO3	2	2	3				2	2			2	
CO4	3			2				3	2			2
CO5	2	2	3	3	2			2		2		
Co Average	2.40	2.00	2.67	2.50	2.00	2.00	2.00	2.33	2.00	2.00	2.00	2.00

RecommendedResources	
Text Books	1. Roger S. Pressman, Software Engineering a Practitioners Approach, McGraw-Hill (2008). 2. J. Bowan, Formal Specification and Documentation using Z - A Case Study Approach, International Thomson Computer Press (2003). 3. Antoni Diller, Z., An Introduction to Formal Methods (second edition), Wiley, 2nd edition (1994).
Reference Books	1. M. Dyer, The Cleanroon Approach to Quality Software Development, Wiley (1992). 2. Prowell, S., Trammell, C.J. and Poore, J.H, Cleanroom Software Engineering: Technology and Process, Addison-Wesley, Massachusetts (1999). 3. Allen, Frost, Yourdon, Component-Based Development for Enterprise

Systems: Applying the Select Perspectives, Cambridge University Press (1998).
4. Zantinge and Adriaans, Managing Client/Server, Addison-Wesley (1996).

Course: UI Frameworks	**Course Code: MCA 103**

Teaching Scheme (Hrs/Week)				**Continuous In- course Assessment (CIA) (30%)**			**End Semester Examination (70%)**		**Total**
L	**T**	**P**	**C**	**CIA-1 (Class participation)**	**CIA-2 (Assignment)**	**CIA-3 (Prelim- MCQ)**	**Theory**	**T/P**	
3	**1**	**0**	**4**	**10**	**10**	**10**	**70**	**00**	**100**
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To enhance the students for implementing UI Frameworks.
2	To apply basic programming using CSS.
3	To implementBootstrap JavaScript.
4	To learn a variety of useful tools.
5	To be able to apply JQuery.

Course Content			
Unit No.	**Module No.**	**Content**	**Hours**
1.	Front-end Web UI Frameworks Overview: Bootstrap	How to Use the Learning Resources, What is Full-Stack Web Development? Node.js and NPM Front-end Web UI Frameworks, Introduction to Bootstrap, Responsive Design, Bootstrap Grid System	12
2	Bootstrap CSS Components	Navigation and Navigation Bar, Icon Fonts, User Input, Bootstrap Tables and Cards, Images and Media Alerting Users Navigation and Navigation Bar: Objectives and Outcomes Navigation and Navigation Bar: Additional Resources User Input: Buttons and Forms: Objectives and Outcomes User Input: Additional Resources Displaying Content: Tables and Cards: Objectives and Outcomes Displaying Content: Additional Resources Images and Media: Additional Resources Alerting Users: Objectives and Outcomes Alerting Users: Additional Resources UI Design and Prototyping: Objectives and Outcomes UI Design and Prototyping Report Template UI Design and Prototyping: Additional Resources	12

3	Bootstrap Javascript Components	Bootstrap JavaScript Components Tabs, Pills and Tabbed Navigation Tooltips, Popovers and Modals Carousel Bootstrap JavaScript Components	12
4	Web Tools	Bootstrap and JQuery CSS Preprocessors: Less and Sass Bootstrap, JQuery and Sass Building and Deployment NPM Scripts Task Runners	12
5	**Bootstrap and JQuery**	Objectives and Outcomes Bootstrap and JQuery : Additional Resources CSS Preprocessors: Objectives and Outcomes CSS Preprocessors: Additional Resources Building and Deployment: Objectives and Outcomes Building and Deployment: NPM Scripts: Additional Resources Building and Deployment: Task Runners Building and Deployment: Task Runners: Additional Resources Front-End Web UI Frameworks and Tools: Bootstrap 4: Conclusions Project Implementation: Objectives and Outcomes Final Report Template.	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Describe tools in bootstrape.
CO2	Execute basic programming using CSS.
CO3	Implement Bootstrap JavaScript.
CO4	Perform experiment with scripts and JQuery.
CO5	Design UI Frameworks and select appropriate tools for implementation.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		2			2			2				
CO2	2			2	2		2			2		
CO3				3	3			3	2	2		
CO4		3	3		2						3	2
CO5		3	3			2				2	3	3

Co Average	**2.00**	**2.67**	**3.00**	**2.50**	**2.25**	**2.00**	**2.00**	**2.50**	**2.00**	**2.00**	**3.00**	**2.50**

RecommendedResources	
Text Books	Modular Design Frameworks: A Projects-based Guide for UI/UX Designers September 2017 by James Cabrera.
Reference Books	

Course: Front End Development & Programming using Java	Course Code: MCA 104

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the basic concepts of Java.
2	To apply basic programming using java.
3	To implement interfaces and exception handling.
4	To design the programs using java applet.
5	To develop swing and advance concepts in java.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Unit I	Object oriented and Java Basics: Need for oop paradigm, summary of oop concepts, History of Java, Java buzzwords, JVM –The heart of Java , Java's Magic Bytecode. data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, using final with variables, garbage collection.	12
2	Unit II	Overloading methods and constructors, recursion, nested and inner classes, exploring string class. Extending Classes and Inheritance, Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super", Polymorphism in inheritance.	12
3	Unit III	Interfaces: differences between classes and interfaces, Packages & Interfaces, defining an interface, implementing interface, applying	12

		interfaces, variables in interface and extending interfaces. Exception handling: Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. String handling, Exploring java.util	
4	Unit IV	Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet. Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. AWT classes, window fundamentals, working with frame window, creating frame window in applet, working with, graphics, colors, font, AWT controls.	12
5	Unit V	Swing: Introduction, limitations of AWT, components& containers, exploring swing-JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables. Handling menus, graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Describe programs in the Java programming language that make strong use of classes and objects.
CO2	Execute GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
CO3	Implement interfaces and exception handling.
CO4	Develop the programs using database connectivity.
CO5	Design and implement swing and advance concepts in java.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	3	-	-	3	-	2		3	2
CO2	3		2	-	-	-	2		2	2	3	2
CO3	-	3	-	-	3	2	-	-	2	2	3	2
CO4	2	-	2	3	-	-	2	-	2	2	3	2
CO5	2	3	3	-	3	-	-	3		2	3	3
Co Average	2.50	3.00	2.33	3.00	3.00	2.00	2.33	3.00	2.00	2.00	3.00	2.20

Recommended Resources	
Text Books	1. Java the complete reference, Herbert schildt, 7th editon, TMH. 2. Understanding OOP with Java, updated edition, T. Budd, pearsoneduction.
Reference Books	1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley and sons. 2. An Introduction to OOP, T. Budd, 3rd edition, pearson education. 3. Introduction to Java programming, Y. Daniel Liang, pearson education. 4. An introduction to Java programming and object oriented application development, R.A. Johnson- Thomson. 5. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary 6. Cornell, 8th Edition, Pearson Education. 7. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, 8th Edition, Pearson Education 8. Object Oriented Programming with Java, R.Buyya,S.T.Selvi,X.Chu,TMH. 9. Java and Object Orientation, an introduction, John Hunt, 2nd edition, Springer. 10. Maurachs Beginning Java2 JDK 5 , SPD. 11. Programming and Problem Solving with Java, JM Slack, B S Publications.

Course: Database Design Development	Course Code: MCA 105

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	0	2	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To implement basic concepts of database management systems.
2	To apply concurrency control transactions.
3	To create parallel and distributed databases.
4	To create object database systems.
5	To apply the concepts of data warehousing.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Introduction to DBMS :	Review of Database Concepts, FileOrganization concepts, Normalization.Physical Database Design and Tunning. Index Selection,Overview of Database Tunning, Choices in tuning theconceptual schema.Choices in tunning queries and views, DBMS Benchmarking.Security. Query Processing and Optimization: Overview, Measures of Query Cost Selection Operation, Sorting, Join Operation, Other Operations Evaluation of Expressions. Query Optimization Overview, Transformation of Relational Expressions Estimating Statistics of Expression Results Choice of Evaluation Plans	6
2	Concurrency control transactions and schedule:	ncurrency control, schedule, Serializability, Recoverability, Levels of Consistency, Transaction Models, Lock based councurrency control lock management, specialized locking techniques, control without locking. Two-Phase Locking Protocol. Graph-Based Locking Protocols. Tree Protocol & multiple granularity. Deadlock Handling, detection & Recovery. Crash Recovery, Introduction to crash recovery, Log, Check pointing, Recovery from a system crash. Nested transactions. Transactions on objects.	6
3	Parallel and distributed databases:	Architectures for parallel databases, Parallel query Evaluation and optimization, Parallelizing individual operations.	6

		stributed Databases Introduction: Distributed Data Processing, What is a Distributed Database System? aracteristics of Distributed DDBMS. Design Issues. Distributed DBMS Architecture. Fragmentation and Replication, Catalog management. Distributed Database Design: Top-Down Design Process, Distribution Design Issues, Fragmentation, Allocation, updating distributed data. erview of Query Processing: Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Characterization of Query Processors, Layers of Query Processing, Query Optimization in Distributed Databases; Distributed Query processing, Distributed transaction management, Distributed Concurrency control, Distributed recovery.	
4	**Advanced Data Management:**	Advanced Data Management techniques. Advanced Database Access protocols: Discretionary Access Control Based on Granting and Revoking Privileges; Mandatory Access Control and Role Based Access Control. Overview of Advanced Database models like Mobile databases, Temporal databases, Spatial databases. **Object database Systems:** Objects, Identity, inheritance, Database Design for an ORDBMS, Storage and access methods, Query processing and optimization, Comparing RDBMS with OODBMS and ORDBMS.	6
5	**Data Warehousing**	Data Warehousing, Dimensional Modeling and OLAP The Need Data Warehousing; Data Warehouse Defined; Benefits of Data arehousing; Features of a Data Warehouse; Data Warehouse chitecture; Data Warehouse and Data Marts; Data Warehousing sign Strategies. Dimensional Model Vs ER Model; The Star hema; How Does a Query Execute? The Snowflake Schema; Fact bles and Dimension Tables; Factless Fact Table; Updates To mension Tables, Primary Keys, Surrogate Keys & Foreign Keys; gregate Tables; Fact Constellation Schema or Families of Star ed for Online Analytical Processing; OLTP vs OLAP; OLAP erations in a cube: Roll-up, Drilldown, Slice, Dice, Pivot ; OLAP dels: MOLAP, ROLAP, HOLAP.	6
		Total No. of Hrs	**30**

Course Outcome	
Students should able to	
CO1	Describe basic concepts of database management systems.
CO2	Execute concurrency control transactions.
CO3	Execute parallel and distributed databases.
CO4	Implement object database systems.
CO5	Implement the concepts of data warehousing for schema design and data-mining algorithms used globally.

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		-	2	-	-		2	-	3	3	-	-
CO2	3	3	3	2	-	2	2	2	-	-	-	-
CO3	2	2	2	3	-	-	-	-	-	-	2	2
CO4		-	-	3	3	-	-	-	-	-	2	2
CO5	3	2	3	2	3	-	3	2	-	-	3	-
Co Average	2.67	2.33	2.50	2.50	3.00	2.00	2.33	2.00	3.00	3.00	2.33	2.00

Recommended Resources	
Text Books	1. Database Management System -Raghu Ramkrishna McGraw Hill, International Editions.
Reference Books	1. Silberschatz, A., Korth, H.F., Sudarshan, S., Database System Concepts, McGraw-HillInternational Edition, 2006 (5 th Edition) 2. Elmasri, R., Navathe, S.B., Fundamentals of Database Systems, Fourth Edition, Pearson Education, 3. Desai, B.C., An Introduction to Database Systems, Galgotia Publications, 4. Date, C.J., An Introduction to Database Systems, Pearson Education, 7 th Edition 5. Garcia-Molina, H., Ullman, J.D., Widom, J., Database Systems: The Complete Book, PearsonEducation, 2002.

Course: Front End Development & Programming Lab	**Course Code: MCA 106**

Teaching Scheme (Hrs/Week)				**Continuous In- Course Assessment (CIA) (30%)**			**End Semester Examination (70%)**		**Total**
L	**T**	**P**	**C**	**CIA-1 (Lab participation/ Attendance)**	**CIA-2 (Written Practical Logbook)**	**CIA-3 (Viva/Oral)**	**Written Performance**	**Viva / Oral**	
0	**0**	**4**	**2**	**10**	**10**	**10**	**50**	**20**	**100**
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To teach fundamentals of object oriented programming in Java. Understand various concepts of JAVA.
2	To familiarize Java environment to create, debug and run simple Java programs.

3	To demonstrate java compiler and eclipse platform and learn how to use Net Beans IDE to create Java Application.

List of Programs
1. Write a Java program that prints all real solutions to the quadratic equation ax2 +bx + c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2 -4ac is negative, display a message stating that there are no real solutions. 2. The Fibonacci sequence is defined by the following rule: The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. 3. Write a Java program that uses both recursive and non recursive functions to print the nth value in the Fibonacci sequence. 4. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. 5. Write a Java program to multiply two given matrices. 6. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util) 7. Write a Java program to create a Student class with following fieldsi. Hall ticket number ii. Student Name iii. Department Create 'n' number of Student objects where 'n' value is passed as input to constructor. 8. Write a Java program to demonstrate String comparison using == and equals method. Department of Computer Science and Engineering MLR Institute of Technology- UG - Autonomous-Regulations 9. Write a Java program to read copy content of one file to other by handling all file related exceptions. 10. Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

Course Outcome	
Students should able to	
CO1	Implement Object oriented features using Java.
CO2	Execute the java programmes with polymorphism and inheritance.
CO3	Design and implement exception handling, develop network and window application using awt and swings.
CO4	Design web application projects for society using various tools in java.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-			2	2	3	-	2	2		
CO2	-	3	3	-	-	-	-	-			3	3

CO3	3	-	3	3	-	-	-	3				3
CO4	3.00	3.00	3.00		2.00	2.00		3.00			3.00	3.00
Co Average	3.00	3.00	3.00	3.00	2.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00

Course: Database Design Development Lab	Course Code: MCA 107

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	To implement basic concepts of database management systems.
2	To apply concurrency control transactions.
3	To create parallel and distributed databases.

List of Programs

1. DistributedDatabaseforBookstore
2. DeadlockDetectionAlgorithmfordistributeddatabaseusingwait-forgraph.
3. ObjectOrientedDatabase–ExtendedEntityRelationship(EER).
4. ParallelDatabase–UniversityCounsellingforEngineeringcolleges.
5. ParallelDatabase–ImplementationofParallelJoin&ParallelSort.
6. ActiveDatabase–ImplementationofTriggers&AssertionsforBankDatabase.
7. DeductiveDatabase–ConstructingKnowledgeDatabaseforKinshipDomain(FamilyRelations).
8. StudyandWorkingofWEKATool.
9. QueryProcessing–ImplementationofanEfficientQueryOptimizer.
10. DesigningXMLSchemaforCompanyDatabase

Course Outcome	
Students should able to	
CO1	Implement basic concepts of database management systems using SQL queries.
CO2	Design and deployment of NoSQL databases with real time requirements.
CO3	Develop storage architecture of distributed file systems and apply them for problems.
CO4	Design database schema and entity relationship diagram for any database application of an organization and society.

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	-	2	2	-	2	2	-	-
CO2	-	2	2	2	3	-	-	-	-	-	-	-
CO3	2	2	3	-	3	-	-	3	-	-	2	3
CO4	2.00	2.00		2.00	3.00	2.00		3.00		2.00	2.00	3.00
Co Average	2.00	2.00	2.67	2.00	3.00	2.00	2.00	3.00	2.00	2.00	2.00	3.00

Course: Business Communication	Course Code: MCA 108

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
1	1	0	2	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To make the students aware about business communication.
2	To understand written and oral communication.
3	To gain knowledge of current trends and communication technologies and its business application.
4	To understand the corporate communication.
5	To know business protocols and international communication.

Course Content			
Unit No.	Module No.	Content	Hours
1.		Introduction to Business Communication - What is business communication - Why communication matters - Principles of effective communication - Reading Skills - Listening – Feedback - Barriers of communication - Social communication model Audience profiling - Target group profile - Social communication model - Perception & communication - Attitude & Communication - Collaboration - Interpersonal communication - Business etiquette Communicating effectively in teams - Collaborative writing - Communication for meetings – Non- verbal communication - Professional dressing and body language - Developing business etiquette Communication in a global marketplace - Cultural competency - Recognizing variations in a diverse world - Other Aspects of Communication - Cross Cultural Dimensions of Business Communication - Technology and Communication - The emergence of mobile & its impact in business communication - Ethical & Legal Issues in Business Communication.	6
2		ritten & Visual Business Communication: Types of written business communication - Digital Media - Email - Text messaging - Website content - Blogs - podcast - Social media strategies - Microblogging - Reports - Proposals - Case studies - Executive summaries - Internal communication through - notices, circulars, memos, agenda & minutes, press releases Planning business messages - Three step writing process - Selecting media & channels - Organize information Writing business messages - Audience analysis & adaptation - Message composition - Choice of words - Effective sentences - Editing messages - Review & distributing messages - Introduction to visual communication - Power of images - Design principles - Ethics	6

		of visual communication Visuals for presenting information - Integrating visuals with text - Business videos - Visuals for presenting data - Data visualization.	
3		ıances of Written Communication : Brief messages - Routine requests & messages – Strategy - Examples Negative messages - Three step process for negative messages - Direct & indirect approach to negative messages - Maintaining ethics & etiquettes - Negative messages under different contexts – Regular business communication - Organisational news - Communicating a crisis - Negative performance reviews Persuasive messages - Three step process for persuasive messages - Developing persuasive messages - examples - Strategies for marketing & sales messages - Promotional messages Reports & Proposals - Purposes of a report - Primary & secondary research - Data collection - Findings - Summarizing results - Types of reports - Types of proposals - Drafting & completing reports and proposals	6
4		siness Presentations :Business presentation milestones - Planning a presentation - Developing a presentation - Delivering a presentation - Incorporating technology Effective presentations - Enhancing presentations - Designing effective slides - Creating effective slide content - Support materials Types of business presentations - Building business presentations for various scenario.	6
5		mmunication for Interviews & Employment : Employers perspective - Identifying employment strategy - Writing employment messages - Job descriptions Candidates perspective - Building CVs - network building - designing portfolios Interviews – Types of interviews - Web /video conferencing - Tele-meeting - Preparing for a job interview – Follow-up communication .	6
		Total No. of Hrs	30

Course Outcome	
Students should able to	
CO1	Demonstrate ability to write error free by optimum use of correct business communication.
CO2	Distinguish between various hierarchy of organizational communication and communication barriers
CO3	Implement principles of critical thinking problem solving with technical proficiency in business communication
CO4	Develop effective interpersonal communication skills that maximize team dynamics
CO5	Develop and understanding of communication process in an organizational and societal setup.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**

CO1	-	-	-	-		3	3	-		2	2	3
CO2	-	-	-	-		-	-	-	2	2	2	3
CO3	-	-	2	-	-	3	3	-	3		2	2
CO4	-	-		-	-	-	-	2	3	2	2	2
CO5	-	-	2	-	2	-	-	3	2		3	3
Co Average	-	-	2.00	-	2.00	3.00	3.00	2.50	2.50	2.00	2.20	2.60

RecommendedResources	
Text Books	1. Business Communication Today, L. Bovee Courtland, Thill John, Lal Raina Roshan, 13th Edition, Pearson 2. Essentials of Business Communication, Rajendra Pal, J.S. Korlahalli, 13th Edition, Sultan Chand & Sons 3. Excellence in Business Communication, John V. Thill, Courtland L. Bovee, Pearson
Reference Books	1. Business Communication, Meenakshi Raman, Prakash Singh, 2nd Edition, 2012, Oxford 2. 2. Supplementary Reading Material Business Communication - Harvard Business Essentials Series, HBS Press

MCA: SEMESTER II

Course: Applied Machine Learning	Course Code: MCA 201

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand various key paradigms for machine learning approaches.
2	To familiarize with the mathematical and statistical techniques used in machine learning.
3	To understand and differentiate among various machine learning techniques.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Introduction:	Definitions, Datasets for Machine Learning, Different Paradigms of Machine Learning, Data Normalization, Hypothesis Evaluation, VC-Dimensions and Distribution, Bias-Variance Tradeoff, Regression.	12
2	Bayes Decision Theory:	Bayes decision rule, Minimum error rate classification, Normal density and discriminant functions.	12
3	Parameter Estimation:	Maximum Likelihood and Bayesian Parameter Estimation. Discriminative Methods: Distance-based methods, Linear Discriminant Functions, Decision Tree, Random Decision Forest and Boosting.	12
4	Feature Selection:	Feature Selection and Dimensionality Reduction: PCA, LDA, ICA, SFFS, SBFS. Clustering: k-means clustering, Gaussian Mixture Modeling, EM-algorithm.	12
5	Kernel Machines:	Kernel Tricks, SVMs (primal and dual forms), K-SVR, K-PCA. Artificial Neural Networks: MLP, Backprop, and RBF-Net. Foundations of Deep Learning: DNN, CNN, Autoencoders.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Formulate a machine learning problem.
CO2	Select an appropriate pattern analysis tool for analyzing data in a given feature space.
CO3	Apply pattern recognition and machine learning techniques such as classification and feature selection to practical applications and detect patterns in the data.

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	-	3	3	-	3	-	-
CO2	2	3	3	3	2	-	2	2	-	2	-	-
CO3	3	3	3	2	3	-	3	3	-	3	-	-
Co Average	2.67	3.00	2.67	2.67	2.33	-	2.67	2.67	-	2.67	-	-

Recommended Resources

Text Books

1. Shalev-Shwartz,S., Ben-David,S., (2014), Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition.

Reference Books

1. Mitchell Tom (1997). Machine Learning, Tata McGraw-Hill.
2. C. M. BISHOP (2006), Pattern Recognition and Machine Learning, Springer-Verlag New York, 1st Edition.

Course: Statistical Data Analytics with R	Course Code: MCA 202

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To learn the computational approaches to Modelling and Feature Extraction.
2	To Learn the need and application of Map Reduce.
3	To learn the various search algorithms applicable to Big Data.
4	To analyse and interpret streaming data.
5	To learn how to handle large data sets in main memory.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Data Mining and Large-Scale Files:	Introduction to Statistical modelling, Machine Learning, Computational approaches to modelling, Summarization, Feature Extraction, Statistical Limits on Data Mining, Distributed File Systems, Map-reduce, Algorithms using Map Reduce, Efficiency of Cluster Computing Techniques.	12
2	Mining Data Streams:	Stream Data Model, Sampling Data in the Stream, Filtering Streams, Counting Distance Elements in a Stream, Estimating Moments, Counting Ones in Window, Decaying Windows Clustering Introduction to Clustering Techniques, Hierarchical Clustering, Algorithms: K-Means, CURE, Clustering in Non-Euclidean Spaces, Streams and Parallelism, Case Study: Advertising on the Web-Recommendation Systems	12
3	Introduction to NOSQL:	Definition of NOSQL, History of NOSQL and Different NOSQL products, Exploring MondoDB Java/Ruby/Python, Interfacing and Interacting with NOSQL	12
4	Introduction to Basics of NOSQL:	NOSQL Basics NOSQL Storage Architecture, CRUD operations with MongoDB, Querying, Modifying and Managing NOSQL Data stores, Indexing and ordering datasets (MongoDB/CouchDB/Cassandra) Creation of parallelized collections and external datasets, Resilient Distributed Dataset (RDD) operations, shared variables and keyvalue pairs.	12
5	Spark application programming:	Spark application programming Purpose and usage of the Spark Context, Initialize Spark with the various programming languages, Describe and run some Spark examples, Pass functions to Spark, Create and run a Spark standalone application, Submit applications to the cluster, Introduction to Spark libraries.	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Explain algorithms by employing Map Reduce technique for solving Big Data problems.
CO2	Identify algorithms for Big Data by deciding on Features set.
CO3	Implement algorithms for handling big size datasets and propose solutions for Big Data by optimizing main memory consumption.
CO4	Design solutions for problems in Big Data by suggesting appropriate clustering techniques.
CO5	Design spark application program for Big Data which is used globally.

CO-PO Correlation	Program Outcomes											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	2	3	1	3	1	2	1	1	3
CO2	3	3	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	3	2	2	2	2	2	1	2
CO4	2	3	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Co Average	2.40	2.60	2.20	2.00	2.40	1.80	2.20	1.80	2.00	1.80	1.60	2.20

RecommendedResources	
Text Books	1. Mining of Massive Datasets, Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Cambridge University Press, Second Edition, 2014. 2. Data Mining Concepts and Techniques, Jiawei Han, MichelineKamber, Jian Pei, Morgan Kaufman Publications, Third Edition, 2011. 3. Data Mining – Practical Machine Learning Tools and Techniques, Ian H.Witten, Eibe Frank, Morgan Kaufman Publications, Third Edition, 2011.
Reference Books	1. Principles of Data Mining, David Hand, HeikkiMannila and Padhraic Smyth, MIT PRESS. 2. Dan Sullivan, NoSQL for Mere Mortals,1st Edition, Pearson Education, 2015. (ISBN-13: 978-9332557338) 6. https://cognitiveclass.ai/courses/what-is-spark

Course:Reinforcement Learning (Elective 1)	Course Code: MCA 203

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To archive a goal by interacting with their environment.
2	To implement in code common algorithms following code standards and libraries used in RL (as assessed by the assignments and final project)
3	To provide Training to the students to frame reinforcement learning problems.
4	To tackle algorithms from dynamic programming, Monte Carlo and temporal-difference learning.
5	To Progress towards larger state space environments using function approximation, deep Q-networks and state-of-the-art policy gradient algorithms.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Introduction	Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. **Probability Primer** Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence	12
2	Markov Decision Process	Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and	12

		policies, Bellman optimality equations.	
3	**Prediction and Control by Dynamic Programing**	Overiew of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evalutation and value iteration algorithms, DP extensions.	12
4	**Monte Carlo Methods for Model Free Prediction and Control**	Overiew of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling. **TD Methods** Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.	12
5	**Function Approximation Methods**	Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, Afterstates, Control with function approximation, Least squares, Experience replay in deep Q-Networks. **Policy Gradients** Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Learn to archive a goal by interacting with their environment.
CO2	Implement in code common algorithms following code standards and libraries used in RL (as assessed by the assignments and final project)
CO3	Train students to frame reinforcement learning problems.
CO4	Tackle algorithms from dynamic programming, Monte Carlo and temporal-difference learning.
CO5	Progress towards larger state space environments using function approximation, deep Q-networks and state-of-the-art policy gradient algorithms.

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	2	1	2	2	1	2	3	3
CO2	2	2	2	2	3	1	2	2	1	3	3	2
CO3	2	3	3	2	2	2	3	3	1	2	3	2
CO4	3	2	2	3	3	1	2	3	1	2	2	2
CO5	2	2	2	2	2	1	2	3	1	2	3	2
Co Average	2.20	2.20	2.20	2.40	2.40	1.20	2.20	2.60	1.00	2.20	2.80	2.20

Recommended Resources

Text Books

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012)

Reference Books

3. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach."Pearson Education Limited, 2016.
4. Goodfellow, Ian, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2016.

Course: Enterprise Application Development (Elective 2)	**Course Code: MCA 203**

Teaching Scheme (Hrs/Week)				**Continuous In- course Assessment (CIA) (30%)**			**End Semester Examination (70%)**		**Total**
L	**T**	**P**	**C**	**CIA-1 (Class participation)**	**CIA-2 (Assignment)**	**CIA-3 (Prelim- MCQ)**	**Theory**	**T/P**	
3	**1**	**0**	**4**	**10**	**10**	**10**	**70**	**00**	**100**
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To Introduce Enterprise Application.
2	To learn about Web Tier and its implementation.
3	To study and perform Enterprise Information Systems Tier.
4	To study and implement Business Tier system.
5	To learn Enterprise Mobility.

Course Content			
Unit No.	**Module No.**	**Content**	**Hours**
1.	Introduction to Enterprise Application	Enterprise Architecture – life cycle, development framework, architectural model, conceptual layers, enterprise IT architecture domain. Enterprise Server – introduction, different types of enterprise servers, set up clusters. Enterprise Resource Planning (ERP) - Customer Relationship Management (CRM) - SCM – HRM. Enterprise Java – Introduction to web application and its lifecycle; Different containers.	12
2	Web Tier	XML and Java API for XML processing – Introduction to JAXP; DOM, SAX and StAX interface; XSLT, Servlets – Introduction; servlet life cycle; sessions; session tracking using hidden fields, user authentication, URL rewriting and Cookies; Inter-servlet communication , Java Server Pages (JSP) – introduction to JSP tags; JSP Life Cycle; Directives; Custom JSP tags, Java Server Faces Technology – Introduction; Page Navigation; Tags; Life Cycle and Architecture.	12
3	Enterprise Information Systems Tier	Java Database Connectivity – Introduction; Different types of drivers; Steps to establish a connection and query it, Java Persistence API – JPA Architecture; Entities; Entity Relationship; Managing Entities, Java Transaction API (JTA) – Transactions in J2EE; Serializability; Concurrent transactions; Distributed transaction and transaction manager, Mobile Database – Need for mobile database; Architecture;	12

		different products; Mobile transactions	
4	Business Tier	Enterprise JavaBeans (EJB) – EJB container; enterprise beans; Session beans; Message-driven beans, JAX-WS Web service endpoints – introduction to creating web services and client, Business Intelligence and Data warehousing – Data model, Data integrity, OLAP, Application in an enterprise, Model-View-Controller (MVC) Architecture – Introduction, Model1 and Model 2 architecture	12
5	Enterprise Mobility	Introduction to Enterprise Mobility : Trends and benefits; Drivers; Risks and analysis, Enterprise Mobility Architecture – High level architecture; Building Units; Capability Model; Meta Model – Mobile Device Security; Enterprise Mobility infrastructure : Secure VOIP, Enterprise Mobility Middleware and Solutions - MEAPs, Native Apps, HTML5., Use Cases .	12
		Total No. of Hrs	**60**

Course Outcome	
Students should able to	
CO1	Describe Enterprise architecture and its Applications.
CO2	Implementation of Web Tier and tools.
CO3	Implement Enterprise Information Systems Tier.
CO4	Study and implement Business Tier system accepted globally.
CO5	Develop Enterprise Mobility with High level architecture.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	3	2	1	2	2	1	2	3	3
CO2	2	2	2	2	3	1	2	2	1	3	3	2
CO3	2	3	3	2	2	2	3	3	1	2	3	2
CO4	3	2	2	3	3	1	2	3	1	2	2	2
CO5	2	2	2	2	2	1	2	3	1	2	3	2
Co Average	2.20	2.20	2.20	2.40	2.40	1.20	2.20	2.60	1.00	2.20	2.80	2.20

Recommended Resources	
Text Books	Head First Servlets and JSP by Bryan Basham, Kathy Sierra, and Bert Bates from O'Reilly Media, INC, 2008

Reference Books	1. Java Server Faces: The Complete Reference by Chris Schalk, Ed Burns and James Holmes, 2006 2. A Practical Guide to Enterprise Architecture by James McGovern, 2003. 3. Java EE 6 Development using GlassFish Application Server by David R. Heffelfinger, Packt Publishing, 2009.

Course: Deep Learning (Elective 1)	Course Code: MCA 204

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the basic concepts of Neural Network.
2	To apply Neural Network architectures.
3	To implement Applications of Deep Learning to computer vision.
4	To apply Applications of Deep Learning to NLP.
5	To implement Parsing and Sentiment Analysis.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Introduction	Feedforward Neural networks. Gradient descent and the backpropagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout.	12
2.	Neural Networks:	Convolutional Neural Networks: Architectures, convolution / pooling layers. Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM. Attention and memory models, Dynamic memory networks.	12
3	Applications of Deep Learning to Computer Vision:	Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks.	12
4	Applications of Deep Learning to NLP:	introduction to NLP and Vector Space Model of Semantics. Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-ofWords model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning. Named Entity Recognition, Opinion Mining using Recurrent Neural Networks.	12
5	Parsing and Sentiment	Parsing and Sentiment Analysis using Recursive Neural Networks. Sentence Classification using Convolutional Neural Networks.	12

	Analysis:	Dialogue Generation with LSTMs. Applications of Dynamic Memory Networks in NLP. Recent Reseearch in NLP using Deep Learning: Factoid Question Asnwering, similar question detection, Dialogue topic tracking, Neural Summarization, Smart Reply.	
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	understand the basic concepts of Neural Network.
CO2	apply Neural Network architectures used in global applications.
CO3	implement Applications of Deep Learning to computer vision.
CO4	apply Applications of Deep Learning to NLP
CO5	implement Parsing and Sentiment Analysis.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	3	2	1	2	2	1	2	3	3
CO2	2	2	2	2	3	1	2	2	1	3	3	2
CO3	2	3	3	2	2	2	3	3	1	2	3	2
CO4	3	2	2	3	3	1	2	3	1	2	2	2
CO5	2	2	2	2	2	1	2	3	1	2	3	2
Co Average	2.20	2.20	2.20	2.40	2.40	1.20	2.20	2.60	1.00	2.20	2.80	2.20

RecommendedResources	
Text Books	1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015). 2. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127. 3. Hochreiter, Sepp, and JargenSchmidhuber. "Long short-term memory." Neural computation 9.8 (1997): 17351780.
Reference Books	1. Oquab, Maxime, et al. "Learning and transferring midlevel image representations using convolutional neural networks." Proceedings of the IEEE conference on computer vision and pattern recognition. 2014. 2. Bengio, Yoshua, et al. "A neural probabilistic language model." journal of machine learning research 3. Feb (2003).

Course: Application Integration	Course Code: MCA 104

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
3	1	0	4	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the features and tools used in Android programming.
2	To understand the concept developing tools.
3	To write a program using Android.
4	To understand the User Interface Architecture.
5	To use User Interface Design.

Course Content			
Unit No.	Module No.	Content	Hours
1.	Introduction to Android:	Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation.	12
2	Building Application:	Building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.	12
3	Android Application Design Essentials	Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	12
4	Managing Application Resources:	Managing Application Resources: Resource Value Types, Accessing Resources Programmatically, Working with Different Types of Resources: Working with String Resources, Working with String Arrays, Colors	12
5	Android User Interface	Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and	12

	Design:	Working with Animation. Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. Mini Project	
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Understands the working of Android OS Practically.
CO2	Develop Android user interfaces.
CO3	Develop, deploy and maintain the Android Applications used globally.
CO4	Utilize Resources to manage application.
CO5	Implement user Interface and design implementations.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	3	3	3	3	2	3	2
CO2	2	3	2	3	3	2	3	3	2	2	3	2
CO3	3	2	3	3	2	2	2	3	2	2	3	2
CO4	2	3	2	2	2	2	2	3	2	3	3	2
CO5	3	2	2	2	2	3	3	2	3	3	3	2
Co Average	2.60	2.60	2.20	2.40	2.20	2.40	2.60	2.80	2.40	2.40	3.00	2.00

Recommended Resources	
Text Books	1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012. 2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013.
Reference Books	1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.

Course: Software Testing and Quality Assurance	Course Code: MCA 205

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Class participation)	CIA-2 (Assignment)	CIA-3 (Prelim- MCQ)	Theory	T/P	
2	0	2	3	10	10	10	70	00	100
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	To understand the basic view of software quality and quality factors.
2	To understand the Software Quality Assurance (SQA) architecture and the details of its components.
3	To understand of how the SQA components can be integrated into the project life cycle.
4	To be familiar with the software quality infrastructure.

Course Content			
Unit No.	Module No.	Content	Hours
1.		Introduction to software Quality and Assurance The software quality challenge, Software quality, Software quality factors Management and its role in software quality assurance	12
2		Components of SQA The components of the software quality assurance system – overview Pre-project Software Quality Components Contract review, Development and quality plans	12
3		SQA Components in the Project Life Cycleand Strategies Integrating quality activities in the project life cycle, Reviews, Software testing – strategies	12
4		Software Testing – Implementation: Software Quality Implementation, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools and their effect on software quality	12
5		Software Quality Infrastructure Components Procedures and work instructions, Staff training and certification, Corrective and preventive actions, Documentation control. Software Quality Metrics Software Quality metrics, Cost of Quality.	12
		Total No. of Hrs	60

Course Outcome	
Students should able to	
CO1	Explain the basic view of software quality and quality factors.
CO2	Identify the Software Quality Assurance (SQA) architecture and the details of its components.
CO3	Implement the SQA components can be integrated into the project life cycle useful for

	society.
CO4	Testing of software tools and software quality infrastructure.
CO5	Plan software quality infrastructure.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	3	2	1	2	1	3	2	3	1
CO2	2	3	3	2	3	2	1	2	2	2	2	2
CO3	2	3	2	2	3	2	2	2	3	3	3	2
CO4	2	3	3	3	3	3	2	2	3	2	3	2
CO5	3	2	3	2	3	2	1	-	2	2	2	-
Co Average	2.20	2.80	2.60	2.40	2.80	2.00	1.60	1.75	2.60	2.20	2.60	1.75

RecommendedResources	
Text Books	1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.
Reference Books	1. KshirsagarNaik and Priyadarshi Tripathy, Software Testing & Quality Assurance Theory and Practice, Wiley Student edition 2. William E. Perry, Effective Methods for Software Testing, WILLEY, 3rd Edition. 3. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 1997. 4. M G Limaye, Software Testing, Tata McGraw-Hill Education, 2009

Course: Machine Learning Lab	Course Code: MCA 206

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	50	20	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives

1.	Make use of Data sets in implementing the machine learning algorithms.
2.	Implement the machine learning concepts and algorithms in any suitable language of choice.

List of Programs

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Course Outcome

Students should able to

CO1	Implementing the machine learning algorithms using data sets.
CO2	Implement the machine learning concepts and algorithms in any suitable language of choice for global applications.
CO3	Design Artificial Neural Network using Machine Learning algorithm.
CO4	Develop and implement Regression algorithm and K-nearest neighbour algorithm.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	2	2	1	2	1	1	2	3	2
CO2	2	2	2	2	3	1	2	1	1	2	3	2
Co Average	2.00	2.50	2.50	2.00	2.50	1.00	2.00	1.00	1.00	2.00	3.00	2.00

Course: R programming Lab	Course Code: MCA 207

Teaching Scheme (Hrs/Week)				Continuous In- Course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1 (Lab participation/ Attendance)	CIA-2 (Written Practical Logbook)	CIA-3 (Viva/Oral)	Written Performance	Viva / Oral	
0	0	4	2	10	10	10	70	30	100
Max. Time, End Semester Exam (Practical) – 3Hrs.									

Course Objectives	
1	Lear to Develop programming logic using R – Packages.
2	Understand datasets using R – programming capabilities
3	Understand the implementation of various applications using python.

List of Programs

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.

2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,)

3. Write a program to find list of even numbers from 1 to n using R-Loops.

4. Create a data set and do statistical analysis on the data using R.

5. Implement different data structures in R.

6. Create pie chart and bar chart using R.

7. Write a program to demonstrate different number data types , arithmetic operations in python.

8. Write a program to create, concatenate and print a string and accessing substring from a given string.

9. Write a program to demonstrate working with dictionaries in python.

10.Write a python program to define a module and import a specific function in that module to another program.

Course Outcome	
Students should able to	
CO1	Execute R programs using R Programming Environment.
CO2	Implement programming concepts and use R – Data types.
CO3	Design and Debug Python Programs using operators and dictionaries.
CO4	Develop programs to Read and write data from & to files in Python and develop Application using Pygame

CO-PO Correlation	Program Outcomes											
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	-	1	1	-	-	-	-
CO2	3	3	2	2	2	-	1	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	2	2	3	3	-	-	-	-	-	-	-
Co Average	3.00	2.25	2.50	2.25	2.50	-	1.00	1.00	-	-	-	-

Course: Research Methodology with Writing research Paper	Course Code: MCA 208

Teaching Scheme (Hrs/Week)				Continuous In- course Assessment (CIA) (30%)			End Semester Examination (70%)		Total
L	T	P	C	CIA-1	CIA-2	CIA-3	Theory	T/P	

				(Class participation)	**(Assignment)**	**(Prelim- MCQ)**			
2	**0**	**0**	**2**	**10**	**10**	**10**	**70**	**00**	**100**
Max. Time, End Semester Exam (Theory) -3Hrs.									

Course Objectives	
1	Understand various concepts & terms associated with scientific business researchapplication.
2	Know various types of measurement scales & attitude scaling techniques.
3	To be able to apply the principles of sampling and sample size determination to contemporary business research problems.
4	To be able to construct different types of testable hypotheses and interpret the statistical testOutcomes.
5	To be able to formulate alternative research designs for a real-life business research problemand discuss the pros and cons of each design.

Course Content			
Unit No.	**Module No.**	**Content**	**Hours**
1.		Definition of Research, Need of business research, Characteristics of scientific research method, Typical Research applications in business and management. Questions in Research: Formulation of Research Problem – Management Question – Research Question – Investigation Question. The process of business research: Literature review - Concepts and theories - Research questions - Sampling - Data collection - Data analysis - Writing up - The iterative nature of business research process, Elements of a Research Proposal.	06
2		Research Design; Sampling Design: Meaning; Requirement of Research Design, Types of Research Design, Factors Affecting Research Design, Feature of Good Research Design, Sampling Design, Sample, Sampling, Steps in Sampling Design, Criterion of selecting sampling procedure, Sampling Methods.	06
3		Measurement; Scaling Technique, Scale characteristic, Measurement Scales: Nominal, Ordinal, Interval, Ratio, Criterion for good Measurement: Validity, Reliability, Sensitivity, Scaling Techniques: Rating Scales, Ranking Scales., Factors in selecting appropriate measurement scale	06
4		Data Collection, Types; Sources of Data: Primary; Secondary, Methods of Primary Data Collection, Observation: Characteristic, Merits. Demerits, Interview: Characteristic, Types, Steps, Merits Questionnaire: Wording Questions, guidelines for constructing questions, best questions, sequence formulating Questionnaire, Merits; Demerits, Schedule, Schedule vs Questionnaire, Qualitative research: Meaning, Uses of qualitative research, Qualitative vs Quantitative research, Orientations: Phenomenology, Ethnography, Grounded theory, Case studies. Techniques in qualitative research: Focus groups, Depth interviews, conversations, semi structured interviews, Social Networking, Observations, collages, Free Association technique, projective techniques. Methods of Secondary Data	06

5		Testing of Hypotheses; Report Writing, Basic Concept Concerning Testing of Hypotheses, Procedure for Hypotheses Testing, Advanced Tools For Hypothesis Testing Using SPSS, Introduction to SPSS package, creating data files, Multiple Response sets, Recoding, visual binning etc. Multivariate Data Analysis: Factor Analysis, Cluster analysis, (Numericalare not Expected in Exam), Interpretation & Report Writing, Interpretation: Meaning, Techniques, Precautions, Effective use ofgraphic aid: Tables, charts, pie charts, line graphs, bar charts, Organization of the written report	06
		Total No. of Hrs	30

Course Outcome	
Students should able to	
CO1	Explain various concepts and terms associated with scientific business Research.
CO2	Apply the various types of measurement scales; attitude scaling techniques and their application in the context of research.
CO3	Design a variety of data collection instruments for contemporary business research issues and apply the principles of sampling.
CO4	Analyse and graphically present quantitative data and derive actionable inferences.
CO5	Formulate alternative research designs for a real-life business research problem used globally and discuss the pros and cons of each design.

CO-PO Correlation	**Program Outcomes**											
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	2	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	2	2	3
CO3	3	3	2	3	2	2	2	3	3	1	2	2
CO4	2	3	2	2	3	3	2	2	2	2	2	2
CO5	2	2	3	2	2	2	2	2	2	1	1	1
Co Average	2.20	2.40	2.20	2.40	2.20	2.20	2.40	2.20	2.40	1.40	1.80	2.20

RecommendedResources	
Text Books	1. Research Methods for Social Work, Allen, Earl R. Babbie, Cengage

	2. Research Methods in Business Studies: A Practical Guide, Pervez Ghauri,Dr KjellGronhaug, FT Prentice Hall
Reference Books	1. Business Research Methods, William G. Zikmund, Barry J. Babin, Jon C.Carr, Mitch Griffin, Cengage Learning 2. Approaches to social research, Royce Singleton, Bruce C. Straits, MargaretMiller Straits, Oxford University Press

Skill based outcomes and monitorable indicators for MCA (competency statements:

On completion of the Master in Computer Application students are able to:

1. Serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software.
2. Serve as the Computer Engineers with enhanced knowledge of computers and its building blocks.
3. Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.
4. Work as the System Engineers and System integrators
5. Serve as the System Administrators with thorough knowledge of DBMS.
6. To Give Technical Support for the various systems.
7. Work as the Support Engineers and the Technical Writers
8. Work as Consultant and Management officers for system management.
9. Work as IT Sales and Marketing person.
10. Serve as the IT Officers in Banks and cooperative societies.
11. Work as DTP Operator in small-scale industries.
12. Serve as the Web Designers with latest web development technologies

12. SCHEME OF EXAMINATION: FOR MCA

Following are the types of paper under consideration:

I. Theory Only Course

II. Theory with practical course (where practical is tool based or lab based Only)
III. Theory with project course (where project is Social or Industry)
IV. Practical Only Course (where practical is tool based or lab based Only) Mini Project or Project
V. Project/ Mini Project as credit course

I) Theory Only courses - Course without any practical/ Project component-

INTERNAL ASSESSMENT (UG+PG)				
Assessment tool	**Total Marks**	**Marks reduced to**	**Modality**	**Duration**
Mid test I	30	10	MCQ	30 minutes
Mid test II	30	10	MCQ	30 minutes
Mini Project/ Assignment		10	Individual project to be submitted by the Learners and presentation/Viva- voce supervised by the concerned faculty (or) MCQ of not less than 20 may be administered spreading over all units (or) Seminar regarding topics of relevance (or) Two assignments in relevant areas each carrying 5 marks (or) May include combination of any of the above mentioned assessment (or) Completion of One edx / Cousera/ Swayam or NPTEL courses specified by the Faculty / Online MBA for reputed university	Semester long
Total		30		

SUMMATIVE EXAMINATION			
Assessment tool	**Total Marks**	**Modality**	**Duration**
End Semester Examination	70	**UG and PG:** 10 MCQ (1 mark each),	3 hours

		10 BAQ (2 marks each), 5 SAQ (4 marks each), 2 LAQ (10 marks each)	
Total	100		

II) Theory with LAB Practical (where practical is tool based or lab based Only) courses - Course with practical component-

COURSE NATURE: PRACTICAL						
Assessment Method (Max. Marks:100)						
Internal Assessment	**Assessment Tool**	**Observation Note Book**	**Output Result**	**Model Examination**	**Regularity and Discipline**	**Total**
	Marks	10	10	5	5	30
Summative Assessment	**No Practical in Summative exams**					

INTERNAL ASSESSMENT- Theory (UG+PG)				
Assessment Tool	**Total Marks**	**Marks reduced to**	**Modality**	**Duration**
Mid test I	**30**	**10**	**MCQ**	**30 minutes**
Mid test II	**30**	**10**	**MCQ**	**30 minutes**
			Individual project to be submitted by the Learners and presentation/Viva- voce supervised by the concerned faculty **(or)** **MCQ of not less than 20 may be administered spreading over all units (or)**	

Mini Project/ Assignment		**10**	**Seminar regarding topics of relevance** **(or)** **Two assignments in relevant areas each carrying 5 marks** **(or)** **May include combination of any of the above mentioned assessment** **(or)** **Completion of One edx / Cousera/ Swayam or NPTEL courses specified by the Faculty / Online MBA for reputed university**	
Total		**30**		**30**

SUMMATIVE EXAMINATION

Assessment Tool	**Total Marks**	**Modality**	**Duration**
End Semester Examination	**70**	**UG and PG:** **10 MCQ (1 mark each),** **10 BAQ (2 marks each),** **5 SAQ (4 marks each),** **2 LAQ (10 marks each)**	**3 hours**
Total	**100**		

Summative Assessment-Theory		
Assessmenttool	**Marks**	**Duration**
Written Test **UG& PG:**	70	3 hours

10 MCQ (1 mark each), 10 BAQ (2 marks each), 5 SAQ (4 marks each), 2 LAQ (10 marks each)		
Total (Theory + Practical)	100	

III) Theory with project – Social or Industry (where project is Social or Industry engagement) courses

COURSE NATURE : MINI PROJECT/ PROJECT						
Assessment Method (Max.Marks: 30)						
Internal Assessment	**Assessment Tool**	**Review1 (Abstract)**	**Review 2 (Analysis)**	**Review 3 (Findings and Conclusion)**	**Viva- Voce**	**Total**
	Marks	5	10	10	5	30
Summative Assessment	**No Project in Summative exams**					
Total						30

INTERNAL ASSESSMENT- Theory (UG+PG)				
Assessment tool	**Total Marks**	**Marks reduced to**	**Modality**	**Duration**
Mid test I	**30**	**10**	**MCQ**	**30 minutes**

Mid test II	**30**	**10**	**MCQ**	**30 minutes**
Mini Project/ Assignment		**10**	**MCQ of not less than 20 may be administered spreading over all units (or)** **Seminar regarding topics of relevance** **(or)** **Two assignments in relevant areas each carrying 5 marks** **(or)** **May include combination of any of the above mentioned assessment** **(or)** **Completion of One edx / Cousera/ Swayam or NPTEL courses specified by the Faculty / Online MBA for reputed university**	
Total		**30**		**30**

SUMMATIVE EXAMINATION

Assessment tool	**Total Marks**	**Modality**	**Duration**
End Semester Examination	**70**	**UG and PG:** **10 MCQ (1 mark each),** **10 BAQ (2 marks each),** **5 SAQ (4 marks each),** **2 LAQ (10 marks each)**	**3 hours**
Total	**100**		

Summative Assessment-Theory

Assessmenttool	Marks	Duration
Written Test **UG& PG:** 10 MCQ (1 mark each), 10 BAQ (2 marks each), 5 SAQ (4 marks each), 2 LAQ (10 marks each)	70	3 hours
Total (Theory + Practical)	100	

IV) Courses with Only LAB practical (where practical is tool based or lab based Only) component Laboratory courses

COURSE NATURE: PRACTICAL						
Assessment Method (Max.Marks:100)						
Internal Assessment	**Assessment Tool**	**Observation Note Book**	**Output Result**	**Model Examination**	**Regularity and Discipline**	**Total**
	Marks	10	10	5	5	30
Summative Assessment	**Assessment Tool**	**Record Notebook**	**Program Writing/ Practical experiment**	**Debugging/ Development**	**Result / Output**	**Total**
	Marks	20	20	20	10	70

V) Courses with Only project component

Project assessment

COURSE NATURE : MINI PROJECT/ PROJECT						
Assessment Method (Max.Marks: 100)						
Internal Assessment	**Assessment Tool**	**Review1 (Abstract)**	**Review 2**	**Review 3**	**Viva- Voce**	**Total**
	Marks	5	10	10	5	30
Summative Assessment	**Assessment Tool**	**Report and Presentation**	**Analysis**	**Findings and Conclusion**	**Viva- Voce**	**Total**
	Marks	10	10	20	30	70
Total						100

1. Format of primary and secondary templates for the formative and summative examination will be same for all the ODL , OL and regular courses.

Secondary Template

Total marks 100(70+30)

Set A /B/C

Topic	Weightage	%of total syllabus	Marks attributed		LAQ (10 marks each) 2/4	SAQ (4 marks each) 5/6	BAQ (2 marks each) 10/11	MCQ (1 mark each) 10/10
Unit I	20%	20%	20			1	6	4
Unit II	20%	20%	19		01	2		1
Unit III	20%	20%	19		01	2		1
Unit IV	20%	20%	19		01	1	2	1
Unit V	20%	20%	19		01		3	3
Total	100%	100%	96		04	06	11	10

CLASS TEST I & II (10 MARKS)

<table>
<tr><td></td><td colspan="3"></td><td>Total No of question required for setting tree sets of question paper using three sets (A,B, C) of secondary template</td></tr>
<tr><td></td><td></td><td>Level I
Knowing</td><td>Level II
Understanding</td><td></td></tr>
<tr><td>MCQ 30</td><td>Level I =15
Level II =15</td><td rowspan="2">Definerepeat record list recall name relate underline</td><td rowspan="2">translate restate discuss describe recognize explain express identify locate report review</td><td>30 MCQ x 3= 90 MCQs
1Minute/ MCQ</td></tr>
<tr><td></td><td>Total</td><td></td></tr>
</table>

PRELIM AND END SEMESTER EXAM (UG and PG)
Draft Pattern of Theory Question paper – 70Marks

Duration =3 hrs

LONG ANSWER QUESTION:

Solve any 2 out of 4 (10 Marks x 2 = 20 Marks)
LAQ 1)
LAQ 2)
LAQ 3)
LAQ 4)

SHORT ANSWER QUESTION:

Solve any 5 out of 6 (4 Marks x 5 =20 Marks)
SAQ1)
SAQ2)
SAQ3)
SAQ4)
SAQ5)
SAQ6)

BRIEF ANSWER QUESTION:

Solve any 10 out of 11 (2 Marks X 10 = 20 Marks)
BAQ1)
BAQ2)
BAQ3)
BAQ4)
BAQ5)
BAQ6)
BAQ7)
BAQ8)
BAQ9)
BAQ10)
BAQ11)

MULTIPLE CHOICE QUESTION:
Solve **ALL** 10 out of 10 (1 Marks x10 = 10 Marks)
MCQ1)
MCQ2)
MCQ3)
MCQ4)
MCQ5)
MCQ6)
MCQ7)
MCQ8)
MCQ9)
MCQ10)

Letter Grades and Grade Points (GP) Based on the aggregate of marks obtained through internal assessment and external assessment, each student is awarded a final letter grade at the end of the semester, in each Course. The letter grades and the corresponding grade points, as recommended by UGC, are asfollows:

Letter Grade	**Grade Points**	**Normalized Mark Range**
O (Outstanding)	10	91-100
A+ (Excellent)	9	81-90
A (Very Good)	8	71-80
B+ (Good)	7	61-70
B(Above Average)	6	56-60
C (Average)	5	50-55
F (Fail)	0	<50 Failure due to insufficient marks in the course
Ab(Absent)	0	Failure due to non-appearance in examination
I (Incomplete)	0	Failure due toinsufficient attendance in thecourse.

2. For all the courses 5 sets of question papers will be procured from QP setter.