AC :

Item No.

UNIVERSITY OF MUMBAI

Revised Syllabus

For

Master of Computer Applications: MCA

Year II and III

Under

FACULTY OF TECHNOLOGY

(As per Choice Based Credit and Grading System)

From,

Academic Year 2017-18

From Co-ordinator's Desk:

To meet the challenge of ensuring excellence in Master Program in Computer Applications (M.C.A.: referred as Master of Computer Applications) education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. Inline with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that,

Each Board of Studies shall prepare some Program Educational Objectives(PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of Master of Computer Applications (MCA) education.

Semester based Credit and grading system enables a much required shift in focus from teacher centric to learner centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance. Choice Based Credit and Grading System are implemented for First Year of Master of Computer Applications (M.C.A.) from the academic year 2016-2017. Subsequently this system will be carried forward for Second Year and Third Year of M.C.A. in the academic year's 2017-2018 and 2018-2019 respectively.

Dr. S. K.Ukarande

Co-ordinator,
Faculty ofTechnology,
Member AcademicCouncil
University of Mumbai,Mumbai

Preamble:

The MCA Choice based syllabus is designed considering various modes of effective teaching-learning and assessment that reflect in its interdisciplinary approach required for advanced application course. This integrated teaching methodology allows understanding of interaction between the different business areas required for IT enabled industries. This methodology also allows students to develop multiple skills such as critical logic analysis, numerical ability, Database programming, Algorithmic optimization with testing, networking, report writing, communication skill, presentation skills,independent research,and working with real-life case studies. These skills further enable the students to take a full, active and responsible role in the IT enabled industries.

The syllabus is directional in wide scope and allows the much desired flexibility to keep speed with the ever growing body of knowledge and explorations in IT enabled industriesconsidering human side of enterprise. The course structures are carefully designed so that students get superiority in dealing with diverse situations when they step into the corporate world.

I would like to extend my thanks to Industries like IBM India Pvt. Ltd., Accenture,RBS India Pvt.Ltd., Myglamm, N.I.C. etc for their valuable inputs to strength the scope and contents of the syllabus. I would also like to extend my thanks to all M.C.A. Faculty members for their contribution in designing an outcome based curriculum.

Dr.Dhananjay R.Kalbande

Chairman- Ad-hoc Board of Studies of Computer Application,
Member- Academic Council,
University of Mumbai, Mumbai.

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester III

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA301	Database Management systems	04	--	--	04	--	--	04
MCA302	Java programming	04	--	--	04	--	--	04
MCA303	Information Security	04	--	--	04	--	--	04
MCA304	Operation Research	04	--	--	04	--	--	04
MCA305	Software Testing and Quality Assurance	04	--	--	04	--	--	04
MCAL301	Database Management systems and Software Testing Lab	--	06	--	--	03	--	03
MCAL302	Java Programming and Unified Modeling Language Lab	--	06	--	--	03	--	03
MCAPR 301	Mini Project	--	--	--	--	--	--	02
Total		**20**	**12**	**--**	**20**	**06**	**--**	**28**

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
MCA301	Database Management systems	20	20	20	80	--	--	--	100
MCA302	Java programming	20	20	20	80	--	--	--	100
MCA303	Information Security	20	20	20	80	--	--	--	100
MCA304	Operation Research	20	20	20	80	--	--	--	100
MCA305	Software Testing and Quality Assurance	20	20	20	80	--	--	--	100
MCAL301	Database Management systems and Software Testing Lab	--	--	--	--	25	50	25	100
MCAL302	Java Programming and Unified Modeling Language Lab	--	--	--	--	25	50	25	100
MCAPR 301	Mini Project	--	---	---	---	25	--	25	50
Total		**100**	**100**	**100**	**400**	**75**	**100**	**75**	**750**

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA401	Data Mining and Business Intelligence	04	--	--	04	--	--	04
MCA402	Advanced Web Technology	04	--	--	04	--	--	04
MCA403	Computer Graphics	04	--	--	04	--	--	04
MCA404	Elective 1	04	--	--	04	--	--	04
MCA405	Elective 2	04	--	--	04	--	--	04
MCAL401	Advanced Web Technology and Data Mining and Business Intelligence Lab	--	06	--	--	03	--	03
MCAL402	Computer Graphics and Image Processing Lab	--	06	--	--	03	--	03
MCAL403 Activity Lab	Soft Skill Development	--	02	--	--	02	--	02
Total		**20**	**14**	**--**	**20**	**08**	**--**	**28**

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test 2	Avg.					
MCA401	Data Mining and Business Intelligence	20	20	20	80	--	--	--	100
MCA402	Advanced Web Technology	20	20	20	80	--	--	--	100
MCA403	Computer Graphics	20	20	20	80	--	--	--	100
MCA404	Elective 1	20	20	20	80	--	--	--	100
MCA405	Elective 2	20	20	20	80	--	--	--	100
MCAL401	Advanced Web Technology and Data Mining and Business Intelligence Lab	--	--	--	--	25	50	25	100
MCAL402	Computer Graphics and Image Processing Lab	--	--	--	--	25	50	25	100
MCAL403 Activity Lab	Soft Skill Development	--	--	--	--	50	--	--	50
Total		**100**	**100**	**100**	**400**	**100**	**100**	**50**	**750**

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Elective for Semester IV

SEM IV – Elective I	
Course Code	**Course Name**
MCA4041	Entrepreneurship Management
MCA4042	Business Infrastructure and Management
MCA4043	ERP
MCA4044	Ethics and CSR
SEM IV – Elective II	
Course Code	**Course Name**
MCA4051	Digital Forensics
MCA4052	Simulation and Modelling
MCA4053	Next Generation Networks
MCA4054	AI and Soft Computing

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester V

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA501	Wireless and Mobile technology	04	--	--	04	--	--	04
MCA502	Advanced Distributed Computing	04	--	--	04	--	--	04
MCA503	User Experience Design	04	--	--	04	--	--	04
MCADLE 504	Elective 1 (Departmental level)	04	--	--	04	--	--	04
MCAILE 505	Elective 2 (Institutional Level)	04	--	--	04	--	--	04
MCAL501	Mobile Application and User experience Design Lab	--	06	--	--	03	--	03
MCAL502	Open Source System For ADC Lab	--	06	--	--	03	--	03
MCAPR 501	Mini Project	--	--	--	--	--	--	02
Total		**20**	**12**	**--**	**20**	**06**		**28**

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test 2	Avg.					
MCA501	Wireless and Mobile technology	20	20	20	80	--	--	--	100
MCA502	Advanced Distributed Computing	20	20	20	80	--	--	--	100
MCA503	User Experience Design	20	20	20	80	--	--	--	100
MCADLE 504	Elective 1 (Departmental level)	20	20	20	80	--	--	--	100
MCAILE 505	Elective 2 (Institutional Level)	20	20	20	80	--	--	--	100
MCA L501	Mobile Application and User experience Design Lab	--	--	--	--	25	50	25	100
MCA L502	Open Source System For ADC Lab	--	--	--	--	25	50	25	100
MCAPR 501	Mini Project	--	--	--	--	25	--	25	50
Total		**100**	**100**	**100**	**400**	**75**	**100**	**75**	**750**

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Elective for Semester V

SEM V – Elective 1- Department Level Elective	
Course Code	**Course Name**
MCADLE5041	Big Data Analytics
MCADLE5042	Machine Learning
MCADLE5043	Internet of Things
MCADLE5044	Multimedia System Design
SEM V – Elective 2 - Institute Level Elective	
Course Code	**Course Name**
MCAILE5051	Intellectual property Rights and Patents
MCAILE5052	Research Methodology
MCAILE5053	Management Information System
MCAILE5054	Green Computing

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester VI

Subject Code	Subject Name	Teaching Scheme (Contact Hours)	Credits Assigned	
		Presentation	Project	Total
MCAPR601	Internship – Project	30	15	15
MCA602	Seminar – Research Paper	05	01	01
Total		**35**	**16**	**16**

Subject Code	Subject Nam	Examination Scheme				
		Theory Course				Total
		Internal Assessment			End Sem. Exam.	
		Presentation 1	Presentation 2	Total		
MCA PR601	Internship – Project	25	25	50	100	150
MCA 602	Seminar – Research Paper	--	--	--	50	50
Total		**25**	**25**	**50**	**150**	**200**

SEMESTER III

Subject Code	Subject Name	Credits
MCA301	**Database Management Systems**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA301	**Database Management Systems**	**04**	--	--	**04**	--	--	**04**

Subject Code	Subject Name	Examination Scheme						
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA301	**Database Management Systems**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic Knowledge of data structures

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO301.1	Emphasize on basic concepts to organize, maintain and retrieve information from a DBMS.
CEO301.2	Cover the principles of database systems and recognize how they are used in developing data-intensive applications.
CEO301.3	To study an effective and efficient database system with the help of the rising trends of parallel and distributed databases.

Course Outcomes: At the end of the course, the students will be able to

MCA301.1	Understand various database concepts and apply them in real life applications.
MCA301.2	Determine the manner in which data can be stored, organized and manipulated in a database system.
MCA301.3	Apply various indexing and optimization techniques to process queries.
MCA301.4	Analyze and design database applications using suitable database techniques.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Overview of DBMS**	Overview of Database management System, File systems versus DBMS, Advantages of DBMS, View of data: Data Abstraction, Instances and Schemas, Data Models, Database Languages , Structure of DBMS, Role of DBA	**06**
2	**Database Design using ER Model and Relational Model**	**Overview of design process:** Entity Relationship Model, Constraints, Entity relationship Diagram, Entity Relationship Design Issues, Weak Entity Sets, Extended ER features **The Relational Model:** Concepts of Relational Models, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational data, Logical Database Design: ER to Relational with Case Studies	**06**
3	**Normalization**	Informal Design Guidelines for Relational Schema, Functional Dependencies **Normal forms:** First, Second, Third Normal Form and BCNF.Introduction to De-normalization. Inference Rules for Functional Dependencies, Equivalence of Sets of Functional Dependencies, Minimal Set of Functional Dependencies, Properties of Relational Decomposition-Dependency Preservation, Lossless Join.	**08**
4	**Indexing**	**Overview of indexing**: Clustered Indexes, Primary and Secondary Indexes, Index Data Structures **Tree structured indexing**: Intuition for Tree Indexes, Indexed Sequential Access Methods, B+ Trees, Search, Insert, Delete, Duplicate **Hash Based Indexing**: Static Hashing, Extensible Hashing, Linear Hashing, Extensible Vs Linear Hashing	**10**
5	**Query Evaluation and** **Transaction Management**	Overview of Query Processing and Query Optimization, Query Evaluation Plans.Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. **Concurrency Control**: Lock-Based Protocol, Timestamp-Based, Multi-version Schemes, Deadlock Handling **Recovery: F**ailure Classification, Log Based Recovery	**10**
6	**Parallel and distributed Databases**	**Parallel Databases:** Architecture for Parallel Databases, Parallel Query Evaluation **Distributed Databases:** Types of Distributed Databases, Distributed DBMS Architecture, Storing Data in a Distributed DBMS, Distributed Transaction, Distributed Concurrency Control, Distributed Recovery	**08**
7	**Object database systems**	Structured Data Types, Operations on Structured Data, Inheritance, Objects, Oids and Reference Types, Object oriented versus Object relational	**04**

References:

- Korth, Silberchatz, Sudarshan, “Databse system Concepts”, McGraw Hill,2006
- Raghu Ramakrishnan, Johannes Gehrke,”Database Management Systems”, Third Edition, McGraw Hill2003.
- Elmasari and Navathe, Benjamin Cummins ,”Fundamental of Database System”, Pearson Education,2009
- C. J. Date ,”An Introduction to Database Systems”, 8/e,Pearson Education,2002
- Rob Coronel ,”Database Systems Design, Implementation and Management”, Cengage Publication,2009
- AtulKahate, “Database Management System” Pearson Education. 2006

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA302	**Java Programming**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut.	Total
MCA302	**Java Programming**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA 302	**Java Programming**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic understanding of any Object Oriented Programming Language.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO302.1	Understand fundamentals of object-oriented programming in Java.
CEO302.2	Study various Java programming constructs.
CEO302.3	Learn application development using Java Components.

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

MCA302.1	Solve computational problems using basic constructs.
MCA302.2	Find a solution for real world problems using Java
MCA302.3	Develop Web Applications using Server Side Programming.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1.	**Fundamentals of Java Programming**	Features of Object-oriented Programming, History of Java, Features of Java, JVM Architecture, Differences between C++ and Java,Data types, variable, expressions, operators, control structures, arrays	**03**
2.	**Object and Classes**	Classes, Instance variables, Methods, Constructors, Access Specifiers, Abstract Classes and Wrapper Classes, Autoboxing and Unboxing, Inheritance, Polymorphism, Method Overriding, Use of Static, final, super and this keyword, Garbage collection and finalize method, string and mutable string, Inner Classes	**04**
3.	**Packages and Interfaces**	Package concept, Creating user defined package, Access control protection, Defining interface, Implementing interface.	**02**
4.	**Generics and Collections**	Generics - Generic Class, Creating Generic Classes, Generic Methods, Bounded Type, Collections- Collections and Generics, Collection Classes-Links, Vector, Linked Lists, Maps, HashMap, WildCards, LambdaExpressions - Lambda Type Inference, Lambda Parameters, Lambda Function Body, Returning a Value From a Lambda Expression, Lambdas as Objects	**05**
5.	**Exception Handling**	Exception handling fundamentals, Exception types, Exception as objects, Exception hierarchy, Exception Keywords - Try, catch, finally, throw, throws, Creating User defined Exceptions, Assertion, Annotations	**04**
6.	**Multi-threading**	Java thread model, Life Cycle of Thread, Working with Thread class and the Runnable interface, Thread priorities, ThreadGroup class, Inter thread communication, Synchronization.	**04**
7.	**File handling**	Input streams and Output streams, FileInputStream and FileOutputStream, Binary and Character streams, Buffered Reader/ Writer, Object serialization and Deserialization.	**04**
8.	**Event handling and GUI programming**	Comparison of AWT and SWING, Applet class, Applet API hierarchy , Life cycle of Applet, Delegation Event Model, Event handling mechanisms, Swing components, Swing Component Hierarchy- Basic and Advanced Components, JApplet, Layout managers, Adapter class, Inner class.	**05**
9.	**Database Programming**	JDBC architecture, Types of drivers, Java.sql package, Establishing connectivity and working with connection interface, Working with statement interface, Working with PreparedStatement interface, Working with ResultSet interface, Working with ResultSetMetaData interface.	**05**
10.	**Web development using Servlets**	Introduction to servlets, Servlet vs CGI, Servelet API overview, Servlet Life cycle, Generic servlet, HTTPServlet, ServletConfig, ServletContext, Handling HTTP Request and response –GET / POST method, request dispatching, Using cookies, Session tracking..	**06**
11.	**Web development using JSP**	Introduction to JSP, JSP Architecture, JSP Directives, JSP scripting elements, Default objects in JSP, JSP Actions, JSP with beans and JSP with Database, Error handling in JSP, Session	**06**

		tracking techniques in JSP, Introduction to custom tags, JSTL tags in detail	
12.	**Introduction to Spring Frameworks**	Introduction to Spring Framework, Spring Architecture, Spring Aspect of Object Oriented Concepts – Join Point and Point Cuts.	**04**

References:

- The complete reference JAVA2, Herbert schildt. Tata McGraw Hill
- Programming with Java A Primer, E. Balaguruswamy Tata McGraw Hill
- Core Java for beginners, Sharanam Shah and Vaishali Shah, SPD
- Java 6 Programming Black Book, Wiley –Dreamtech
- Web Enabled Commercial Application Development using java 2.0, Ivan Byaross
- Java Server Programming java EE6, Black book, Dreamtech press.
- Core Servlets and Java Server Pages :Vol I: Core Technologies 2/e , Marty Hall and Larry Brown, Pearson
- Java 6 Programming, Black Book, Dreamtech Press.
- Java Enterprise in a Nutshell, 3rd Edition A Practical Guide, Jim Farley, William Crawford, O'Reilly
- Java EE 6 Server Programming For Professionals, Sharanam Shah and Vaishali Shah, SPD
- Spring in Action, Craig Walls, 3rd Edition, Manning

Web References:

- https://docs.oracle.com

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA303	**Information Security**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA303	**Information Security**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA 303	**Information Security**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Computer Networks, Databases

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO303.1	Understand information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
CEO303.2	Study cryptography and key encryption techniques used today.
CEO303.3	Comprehend relevant security parameters in the internet, web, database systems and applications

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

MCA303.1	Understand the requirement of information security and a clear understanding of its importance
MCA303.2	Be familiar with information security threats and countermeasures, and familiar with information security designs using available secure solutions
MCA303.3	Use the database security mechanisms, intrusion detection systems, formal models of security, cryptography, network ,web security

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction**	Principles of Security, Attacks, Services and Mechanisms, Integrity check, digital Signature, authentication.	**03**
2	**Cryptography**	Private Key Cryptography: Block Encryption, DES Algorithm, Problems with DES, Variations of DES, IDEA Algorithm, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB Public Key Encryption : RSA Symmetric and Asymmetric Key Cryptography together	**08**
3	**Authentication**	Types of Authentication- Password-based authentication, address-based authentication, cryptographic authentication, smart cards, biometrics, mutual authentications, reflection attacks, Message Digest : MD5 ,SHA,MAC ,HMAC, Digital Certificate process, KDC-working, multi domain KDC, Kerberos	**10**
4	**Internet Security**	Transport Layer Security: SSL, SET Email Security : PGP, S/MIME, Comparison, IP security : IPSec, Web Services Security : XML, SOAP, WSDL and UDDI, SSl, WS-Security, SAML, Ws-Trust, WS-Security Policy	**08**
5	**Intrusion Prevention andDetection**:	Introduction, Intrusion Detection Systems , Prevention versus Detection, Types of Intrusion Detection systems, DOS attacks, Flooding Attacks, DdoS Attack Prevention/Detection, Defenses Against Denial-of-Service Attacks, Malware Detection	**06**
6	**Database Security**	The Need for Database Security, Database Access Control, Inference, Statistical Databases , Database Encryption,	**05**
7	**Firewalls**	Characteristics, Packet filters, Application Level Gateways, Circuit Level Gateways, Firewall Architectures, Trusted System,	**06**
8	**IEEE 802.11 Wireless LAN Security**	Background, Authentication: Pre- WEP Authentication, Authentication in WEP, Authentication and key agreement in 802.11i, Confidentiality and Integrity: Data protection in WEP, Data protection in TKIP and CCMP	**06**

References:

- AtulKahate, “Cryptography and Network Security”, McGraw Hill
- Network Security sand Cryptography: Bernard Menezes, CENGAGE Learning
- Cryptography and Information Security, V. K. Pachghare PHI Learning Pvt. Ltd.
- M. Stamp, “Information Security: Principles and Practice,” 2nd Edition, Wiley, ISBN: 0470626399, 2011.
- W. Stallings, “Computer Security: Principles and Practice,” 2nd Edition, Prentice Hall, ISBN: 0132775069, 2011.
- Kaufman C., Perlman R., and Speciner, “Network Security”, Private Communication in a public world, 2nd ed., Prentice Hall PTR.,2002
- Computer Security, 3rd Edition, Dieter Gollmann, December 2010, Wiley Publications

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA304	**Operation Research**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA304	**Operation Research**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA304	**Operation Research**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic knowledge of Mathematics and Statistics.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO304.1	Study formulation, analysis and solving science, engineering and business problems.
CEO304.2	Study mathematics and mathematical modelling using computers to forecast the implications of various choices.
CEO304.3	Study the selection of the best alternatives from the available choices.

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

MCA304.1	Apply Operations research methodology to a broad range of problems in business and industry.
MCA304.2	Use mathematics and mathematical modelling using computers to forecast the implications of various choices.
MCA304.3	Solve optimization problems.
MCA304.4	Think of new methods for solving optimization problems.

Syllabus

Sr No	Module	Detailed Contents	Hrs
1	**Nature of Operation Research**	History ,Nature of Operation Research ,Impact of Operation Research, Application Areas	**01**
2	**Overview of Modeling Approach**	Formulating the problem, Constructing a mathematical model, Deriving a solution, Testing a model and the solution, Establishing control over the solution, Implementation issues	**02**
3	**Linear Programming**	Introduction ,Graphical solution**,** Graphical sensitivity analysis, The standard form of linear programming problems**,** Basic feasible solutions, Simplex algorithm, Artificial variables, Big M and two phase method, Solution to Problems based on Degeneracy, Alternative optima, Unbounded solution, Infeasible solutions.	**12**
4	**Dual Problem**	Relation between primal and dual problems, Dual simplex method, Sensitivity analysis.	**05**
5	**Transportation Problem**	Starting solutions. North-west corner Rule – least cost methods – Vogel's approximation method, MODI Method, Minimization and Maximization problem	**05**
6	**Assignment Problem &Travelling Salesman Problem**	Assignment Problem: Hungarian method (Minimization and Maximization) Traveling Salesman Problem: Branch & Bound technique, Hungarian method	**05**
7	**Sequencing Problem**	Two machines n jobs , three machines n jobs, n machines m jobs	**03**
8	**PERT and CPM**	Arrow network ,Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and slack time**,** Critical path**,** Probability of meeting scheduled date of completion of project**,** Calculation of CPM network **,**Various floats for activities**,** Project crashing.	**06**
9	**Replacement Theory**	Replacement of items that deteriorate, Replacement of items that fail group replacement and individual replacement.	**04**
10	**Integer Programming**	Branch and Bound Algorithm, Cutting plane Algorithm	**06**
11	**Game Theory**	Two person Zero sum games, Solving simple games.	**03**

References:

- Operation Research-An Introduction: Taha H. A., McMillan Publishing Company, NY
- Introduction to Operation Research: Hillier F., and Lieberman G.J, Holden Day
- Operations Research : P. K. Gupta & Hira, S. Chand
- Operations Research Applications and Algorithms: Waynel L. Winston Thomson
- Mathematical Programming Techniques: Kambo, N.S., McGraw Hill
- Operations Research- Principles and Practice: Ravindran, Wiley Production
- Operations Research: L E Prasad, Cengage Learning

- Optimization Methods: K.V. Mital& Mohan New Age
- Operations Research: KantiSwaroop, Gupta P.K. Man Mohan, Sultan Chand and Sons
- Operation Research: S.D. Sharma
- Principles of Operation Research (with applications to managerial decisions) – H.M Wagher,PHI, New Delhi

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA305	**Software Testing and Quality Assurance**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA305	**Software Testing and Quality Assurance**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA305	**Software Testing and Quality Assurance**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Students should have knowledge of Software Engineering theory.

Course Educational Objectives (CEO): At the end of the course, the students will be able to:

CEO305.1	Study importance of Software Testing in Software Development
CEO305.2	Explore appropriate Software Testing Techniques for finding bugs in Software.
CEO305.3	Study various Software Testing Tools and Quality Assurance Methods.

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

MCA305.1	Solve the problems using Software Testing techniques and Approaches.
MCA305.2	Apply various Software testing Techniques to find bugs in software.
MCA305.3	Use open source software Testing Tools.
MCA305.4	Apply various Software Quality Assurance Techniques to ensure the quality in software.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Basics of Software Testing**	Humans, Errors & Testing, Correctness Vs Reliability, Testing & Debugging, Principles of Testing, Test Metrics	**04**
2	**Testing in the Software Life Cycle & Test Levels**	The General V-Model, W-Model, Component Test, Integration Test, System Test, Acceptance Test, Generic types of Testing- Functional, Non Functional, Testing software structure, Regression Testing	**08**
3	**Static Testing**	Structured Group Examinations - Reviews, Static Analysis - Control Flow Analysis & Data Flow Analysis, Tools for Static Testing	**04**
4	**Dynamic Analysis**	Black Box Testing- Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique, User Documentation Testing, Domain Testing, White Box-Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage	**08**
5	**Test Management**	Test Planning, Test Management, Test Process, Test Reporting, Incident Management – Test Log, Incident Reporting, Classification, Status	**08**
6	**Test Automation**	Design and Architecture for Automation, Test Automation- Design and Architecture for Automation, Generic Requirements for test Tool/Framework, Criteria for selecting test tools, Testing of Object Oriented Systems	**08**
7	**Software Quality**	Five Views of software quality, ISO 9126 Quality Characteristics, ISO 9000:2000 & Latest Software Quality Standards, SQA Planning: SQA plan, Organizational Level Initiatives.	**05**
8	**Software Measurement & Metrics**	Measurement during Software Life Cycle Context, Defect Metrics, Metrics for software Maintenance & Requirements, Measurement Principles, Case study for Identifying Appropriate Measures & Metrics for Projects	**07**

References:

- Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors
- "Foundations of Software Testing", by Aditya P. Mathur – Pearson Education custom edition 2000.
- "The ART of Software Testing", by GlenfordJ. Myers, Wiley India, Second Edition
- "Software Testing: Principles and Practices", by Srinivasan D and Gopalswamy R, PearsonEd, 2006.
- "Software Testing & Quality Assurance Theory & Practice" By KshirasagarNaik&PriyadarshiTripathi, Wiley Student Edition.
- "Software Quality Assurance Principles & Practice", by Nina S. Godbole, Narosa.

- Stephan H.Kan, “Metric and Model in Software Quality Engineering”, Addison Wesley, 1995.
- Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Fifth Edition ,McGraw Hill, 2001
- “Advanced Software Testing”, Vol. 2, Rex Black, SPD.

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAL301	**Database Management systems and Software Testing Lab**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAL301	**Database Management systems and Software Testing Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCAL301	**Database Management systems and Software Testing Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:
Basic Knowledge of SQL and Software Engineering concepts

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOL301.1	Make the students understand basic and relatively advanced issues in modern database management, information storage and retrieval.
CEOL301.2	Study various database techniques in developing data-intensive applications.
CEOL301.3	Explore the need of software testing in current industry scenario, understanding and knowledge of foundations, techniques and tools in area of software.
CEOL301.4	Understand the essential characteristics requirements and usage of Automation tools.

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

MCAL301.1	Design database systems using available tools.
MCAL301.2	Develop applications using basic and modern database techniques as per organization requirements.
MCAL301.3	Demonstrate software testing tools
MCAL301.4	Create test design documents and test reports

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**DDL and DML**	**Data Definition Language:** Create, Alter, Drop, Rename, Truncate **Data Manipulation Language:** Insert, Update, Delete, Select	**06**
	Constraints	Not Null, Unique Key, Primary Key, Foreign Key, Check, adding and Dropping a Constraint	**02**
2	**Data Control Language and Transaction Control**	Grant, Revoke, Roles Commit, Rollback	**02**
3	**SQL SELECT Statements**	Column Alias, Concatenation Operator, Arithmetic Operators, ComparisonConditions, Logical Conditions, ORDER BY Clause	**04**
4	**Functions And Subquery**	Single Row Functions, Character Functions, Number Functions, Date Functions, Conversion Functions, Aggregate functions **Subquery:** Types of Subquery, Group by and Having Clause	**06**
5	**Joins and other concepts**	Equijoins, Non-Equijoins, Self Joins, Left Outer Joins, Right Outer Joins, Full Outer Joins, Natural Joins **Other Concepts:** View, Index	**06**
6	**PL/SQL Practical**	**Programming:** Variables, Identifiers, Comment, PL/SQL Block Structure **IF Statements:** Simple IF Statements, Compound IF Statements IF-THEN-ELSE Statements **Loop:** Basic Loop, WHILE Loop, FOR Loop	**06**
7	**Cursor and Trigger**	**Cursor:** Types of Cursor, Explicit Cursor Attributes **Trigger:** Trigger, Statement Trigger, Row Trigger, Using Conditional Operations.	**06**
8	**Functions, Procedures and packages**	Create Function, Function with Arguments, Executing Function, Dropping Function **Procedures:** Block Structure of Subprogram, Types of Subprograms, Procedurewith Parameters, Executing Procedures, Dropping Procedures **Packages:** Package Specification, Package Body, Creating Package, Execution,Dropping Package	**06**
9	**Parallel and distributed database**	**Implementation of different types of Partitions**: Range, Hash, List. **Distributed Database:** Horizontal, Vertical fragmentation	**04**
10	**Object Oriented database**	Implementation ofAbstract Data Type, Inheritance, Reference	**04**
11	**Manual Testing**	• Study of Reviews (Writing Test cases, Testing Framework, Test Document) • Construction of CFG & Deriving Test Cases • Implementation of Test Cases using Unit Testing, Integration & System Testing	**04**

12		• Implementation of Test Cases using Equivalence Class Partitioning, Boundary Value Analysis. • State Transition Test, Cause Effect Graphing and Decision Table Technique.	**04**
13	**Automation Testing**	• Study of Automation Tools. • Building Test Cases. • Using Base URL to Run Test Cases in Different Domains	**06**
14		• Selenium commands-selenese • Matching Text Patterns • Performance Testing Concepts :Load Testing, Stress Testing	**06**
15		• Web Driver Implicit & Explicit Wait • Cross Browser Testing • API Testing	**06**

Note: Automation software testing practical's can be performed using open source tool like selenium.

Reference Books:

- Joel Murach, "Murach's oracle PL /SQL" Joel Murach's publication Murachs and Assocites
- Sharnam shah, Vaishali Shah, "Oracle for Professionals"Publication SPD-Shroff Publishers and Distributors 2011
- RiniChakrabarti, ShilbhadraDasgupta, KLSI, "Advanced Data Base Management System Publication DreamTech
- Chakravarti ,"Advance Data Base Management System", Wiley -Dreamtech
- RajshekharSundaram, "Oracle 10g Programming: A Premier", Publication Pearson Education 2009
- Peter Rob and Coronel, "Database Principals fundamentals of Design, Implementation and Management", Publication Cengage Learning 2011.

Subject Code	Subject Name	Credits
MCAL302	**Java Programming and Unified Modeling Language Lab**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAL302	**Java Programming and Unified Modeling Language Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCAL302	**Java Programming and Unified Modeling Language Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:

Basic understanding of programming fundamentals and software engineering.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOL302.1	Understand, developing, testing and debugging Java programs.
CEOL302.2	Study UML tools
CEOL302.3	Explore object-oriented design using UML

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

MCAL302.1	Develop a simple software application using the object oriented approach.
MCAL302.2	Design and develop a Java Web Applications.
MCAL302.3	Apply UML tools for object oriented software modeling.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs.
1	**Fundamentals of Java Programming**	Program on creation of classes and using different types of function. Program using constructor/method overloading Program on passing Object as parameter to a function Program using static and final variable and methods	**02**
2	**Objects and Classes**	Program to perform different operations on Array and String Program using Interface and Inheritances. Program using Wrapper class to cover auto boxing and un boxing	**04**
3	**Packages and Interfaces**	Programs based on creating and using packages along with access control specification. Programs based on defining, creating and implementing interfaces.	**04**
4	**Generics, Collections and Lambda Expression**	Programs based on Generics, Collections and Lambda Expression	**04**
5	**Exception Handling**	Programs based on exception handling mechanism covering all keywords. Programs based on creating own exceptions.	**04**
6	**Multi-threading**	Programs based on Multithreading approach, thread priorities, Inter thread communication, and Synchronization.	**04**
7	**File Handling**	Programs based on Input streams and Output streams, FileInputStream and FileOutputStream, Binary and Character streams, Buffered Reader/ Writer, Object serialization and Deserialization.	**04**
8	**Event handling and GUI programming**	Programs based on designing GUI Interface. Programs based on creating an applets, use of containers, components, event handling, layout managers, Adapter classes, Inner class etc.	**04**
9	**Database Programming**	Programs based on database connectivity using MS-Access/ Oracle/ MySQL as a backend covering all the database operations.	**04**
10	**Web development using Servlets**	Programs based on handling request and response –GET / POST method, Programs based on cookies	**04**

		and Session tracking.	
11	**Web development using JSP**	Programs demonstrating JSP Syntax and semantics. Programs based on directives and error objects. Programs based on session tracking.	**04**
12	**Introduction to Spring Frameworks**	Basic programs based on Spring framework	**03**
13	**Introduction to UML**	UML Overview, The Nature and purpose of Models	**01**
14	**Modeling Requirements: Use Cases**	Capturing a System Requirement, Use Case Relationships, Use Case Overview Diagrams	**02**
15	**Modeling System Workflows: Activity Diagrams**	Activity Diagram Essentials, Activities and Actions, Decisions and Merges, Doing Multiple Tasks at the Same Time, Time Events, Objects, Sending and Receiving Signals, Starting an Activity, Ending Activities and Flows, Partitions (or Swimlanes), Managing Complex Activity Diagrams	**02**
16	**Modeling a System's Logical Structure: Introducing Classes and Class Diagrams Modeling a System's Logical Structure: Advanced Class Diagrams**	What is a Class?, Getting Started with Classes in UML, Visibility, Class State: Attributes, Class Behavior: Operations, Static Parts of Your Classes Class Relationships, Constraints, Abstract Classes, Interfaces, Templates	**02**
17	**Bringing Your Classes to Life: Object Diagrams**	Object Instances, Links, Binding Class Templates	**01**
18	**Modeling Ordered Interactions: Sequence Diagrams**	Participants in a Sequence Diagram, Time, Events, Signals, and Messages, Activation Bars, Nested Messages, Message Arrows, Bringing a Use Case to Life with a Sequence Diagram, Managing Complex Interactions with Sequence Fragments,	**02**
19	**Focusing on Interaction Links: Communication Diagrams** **Focusing on Interaction Timing: Timing Diagrams**	Participants, Links, and Messages, Fleshing out an Interaction with a Communication Diagrams, Communication Diagrams Versus Sequence Diagrams What Do Timing Diagrams Look Like?, Building a Timing Diagram from a Sequence Diagram, Applying Participants to a Timing Diagram, States, Time, A Participant's State-Line, Events and Messages, Timing Constraints	**02**

20	**Completing the Interaction Picture: Interaction Overview Diagrams**	The Parts of an Interaction Overview Diagram, Modeling a Use Case Using an Interaction Overview	**01**
21	**Managing and Reusing Your System's Parts: Component Diagrams**	What is a Component?, A Basic Component in UML, Provided and Required Interfaces of a Component, Showing Components Working Together, Classes That Realize a Component, Ports and Internal Structure, Black-Box and White-Box Component Views	**02**
22	**Modeling an Object's State: State Machine Diagrams**	Essentials, States, Transitions, States in Software, Advanced State Behavior, Composite States, Advanced Pseudostates, Signals, Protocol State Machines	**02**
23	**Modeling Your Deployed System: Deployment Diagrams**	Deploying a Simple System, Deployed Software: Artifacts, What Is a Node?, Hardware and Execution Environment Nodes, Communication Between Nodes, Deployment Specifications, When to Use a Deployment Diagram	**02**
24	**UML tools and techniques for web-based/object oriented Applications**	UML Tools, Different UML Notations for Web application	**02**
25	**Creation of documentation such as SRS, SDS from UML diagrams. Generation of code from UML model.**	Basic Concept, Generating by Templates, Using Batches, Installing and Uninstalling Templates	**02**
26	**Mini Project**	A Mini – Project based on Java Programming and UML using an integrated approach. (Maximum Two students in a Group).	**10**

Reference Books:

- The complete reference JAVA2, Herbert schildt. Tata McGraw Hill
- Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill
- Core Java for beginners, Sharanam Shah and vaishali shah, SPD
- Java 6 Programming Black Book, Wiley –Dreamtech
- Web Enabled Commercial Application Development using java 2.0, Ivan Byaross
- JDBC, Servlet, and JSP Black Book, Santosh Kumar, Dreamtech
- Java Server Programming java EE6, Black book, Dreamtech press.
- Core Servlets and Java Server Pages :Vol I: Core Technologies 2/e , Marty Hall and Larry Brown, Pearson
- Java 6 Programming, Black Book, Dreamtech Press.
- Spring in Action, Craig Walls, 3rd Edition, Manning
- The Unified Modelling Language Reference manual, Second Edition, James Rambaugh, Iver Jacobson, Grady Booch, Addition- Wesley

- Learning UML 2.0, Kim Hamilton, Russell Miles, O'Reilly
- The Unified Modeling Language User Guide Second edition, Grady Booch, James Rumbaugh, Ivar Jacobson , Addison Wesley (2005)
- Object-Oriented Modeling and Design with UML, Michael Blaha, James Rumbaugh, PHI (2005)
- Designing Flexible Object-Oriented Systems with UML, Charles Richter, Sams

Web References:

1. https://docs.oracle.com
2. http://staruml.sourceforge.net/docs/user-guide(en)/ch08.html
3. https://www.ibm.com/support/knowledgecenter/SS6RBX_11.4.3/com.ibm.sa.oomethod.doc/topics/c_Web_app_Extensions_WAE.html

Subject Code	Subject Name	Credits
MCAPR301	**Mini Project**	**02**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	Tut	Total
MCAPR301	**Mini Project****	--	--	--	--	--	--	**02**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA PR301	**Mini Project**	--	--	--	--	**25**	**-**	**25**	**50**

Pre-requisites:

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOPR301.1	Conceptualize knowledge with emphasis on team work, effective communication, critical thinking and problem solving skills.
CEOPR301.2	Adapt to a rapidly changing environment by having learned and applied new skills and new technologies.
CEOPR301.3	Study designing small projects in a multidisciplinary environment.

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

MCAPR301.1	Design, implement and evaluate a mini-project.
MCAPR301.2	Gain project management skills.
MCAPR301.3	Work effectively in small groups on medium scale computing projects.
MCAPR301.4	Demonstrate the ability to produce a technical document

Sample Guidelines for Preparing and Documenting the Project Report

Sr. No.	Module	Detailed Contents
1	**Introduction**	• Introduction of the project(SRS) • Problem definition • Objective of Project • scope of Project
2	**System Study**	• Existing System • Disadvantages of Existing system • Proposed System • Use Cases
3	**Analysis & Design**	• Software/hardware Requirement Specification o Software requirement o Hardware requirement • GANTT Chart • Flowchart/ DFD/ER/UML diagram(any other project diagram) • Module design and organization
4	**Testing & Validation**	• Test cases and Report (based on manual & automation testing)
5	**User Manual**	• Explanation of Key functions • Method of Implementation o Forms o Output Screens
6	**Conclusion**	• Project Conclusion & Future enhancement

- **Rubrics should be followed for evaluation.**

- **References for report documentation**
  1. Author Name, Title of Paper/ Book, Publisher's Name, Year of publication
  2. Full URL Address

** Mini Project will be performed by students during summer vacation of Even Semester of first year (SEM II) Mini project will be evaluated in SEM III. Evaluation of the mini project will be internal 25 marks as TW and 25 marks as oral examination conducted by External Examiner (Institute Level)

.

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA401	Data Mining and Business Intelligence	04	--	--	04	--	--	04
MCA402	Advanced Web Technology	04	--	--	04	--	--	04
MCA403	Computer Graphics	04	--	--	04	--	--	04
MCA404	Elective 1	04	--	--	04	--	--	04
MCA405	Elective 2	04	--	--	04	--	--	04
MCAL401	Advanced Web Technology and Data Mining and Business Intelligence	--	06	--	--	03	--	03
MCAL402	Computer Graphics and Image Processing	--	06	--	--	03	--	03
MCAL403 Activity Lab	Soft Skill Development	--	02	--	--	02	--	02
Total		**20**	**14**	**--**	**20**	**08**	**--**	**28**

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test 2	Avg.					
MCA401	Data Mining and Business Intelligence	20	20	20	80	--	--	--	100
MCA402	Advanced Web Technology	20	20	20	80	--	--	--	100
MCA403	Computer Graphics	20	20	20	80	--	--	--	100
MCA404	Elective 1	20	20	20	80	--	--	--	100
MCA405	Elective 2	20	20	20	80	--	--	--	100
MCAL401	Advanced Web Technology and Data Mining and Business Intelligence	--	--	--	--	25	50	25	100
MCAL402	Computer Graphics and Image Processing	--	--	--	--	25	50	25	100
MCAL403 Activity Lab	Soft Skill Development	--	--	--	--	50	--	--	50
Total		**100**	**100**	**100**	**400**	**100**	**100**	**50**	**750**

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Elective for Semester IV

SEM IV – Elective I	
Course Code	**Course Name**
MCA4041	Entrepreneurship Management
MCA4042	Business Infrastructure and Management
MCA4043	ERP
MCA4044	Ethics and CSR
SEM IV – Elective II	
Course Code	**Course Name**
MCA4051	Digital Forensics
MCA4052	Simulation and Modelling
MCA4053	Next Generation Networks
MCA4054	AI and Soft Computing

SEMESTER IV

Subject Code	Subject Name	Credits
MCA401	**Data Mining and Business Intelligence**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA 401	**Data Mining and Business Intelligence**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 401	**Data Mining and Business Intelligence**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Basic knowledge of data base concepts

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO401.1	Acquire the knowledge of various concepts and tools behind data warehousing and mining data for business intelligence
CEO401.2	Study data mining algorithms, methods and tools
CEO401.3	Identify business applications of data mining

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

MCA401.1	Use conceptualization of BI techniques
MCA401.2	Apply data warehouse concepts for data analysis and report generation
MCA401.3	Develop industry level data mining skills using software tools
MCA401.4	Make use of relevant theories, concepts and techniques to solve real-world BI problems

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Business Intelligence-**	Introduction and overview of BI-Effective and timely decisions, Data Information and knowledge, BI Architecture, Ethics and BI. BI Applications- Balanced score card, Fraud detection, Telecommunication Industry, Banking and finance, Market segmentation.	**06**
2	**Prediction methods and models for BI**	Data preparation, Prediction methods-Mathematical method, Distance methods, Logic method, heuristic method-local optimization technique, stochastic hill climber, evaluation of models	**06**
3	**BI using Data Warehousing**	Introduction to DW, DW architecture, ETL Process, Top-down and bottom-up approaches, characteristics and benefits of data mart, Difference between OLAP and OLTP. Dimensional analysis- Define cubes. Drill- down and roll- up – slice and dice or rotation, OLAP models- ROLAP and MOLAP. Define Schemas- Star, snowflake and fact constellations.	**08**
4	**Data Mining and Preprocessing**	Data mining- definition and functionalities, KDD Process, Data Cleaning: - Missing values, Noisy data, data integration and transformations. Data Reduction: - Data cube aggregation, dimensionality reduction- data compression, Numerosity reduction- discretization and concept hierarchy.	**06**
5	**Associations and Correlation**	Association rule mining:-support and confidence and frequent item sets, market basket analysis, Apriori algorithm, Incremental ARM, Associative classification- Rule Mining.	**06**
6	**Classification and Prediction**	Introduction, Classification methods:-Decision Tree- ID3, CART, Bayesian classification- Baye'stheorem(Naïve Bayesian classification),Linear and nonlinear regression.	**08**
7	**Clustering**	Introduction, categorization of Major, Clustering Methods:- partitioning methods- K-Means. Hierarchical- Agglomerative and divisive methods, Model- based- Expectation and Maximization.	**08**
8	**Web mining and Text mining**	Text data analysis and Information retrieval, text retrieval methods, dimensionality reduction for text. Web Mining: - web content, web structure, web usage.	**04**

References:

- Business Intelligence data mining and optimization for decision making- by Carlo Vercellis ,wiley publication.
- Adaptive business Intelligence by ZbigniewMichlewicz, martin Schmidt, matthewmichalewicz, constantinChiriac
- Data Mining concepts and techniques second edition by Jiawei Han and MichelineKamber.
- Data Mining:" Introductory and Advanced topics" , Pearson Education, by M.Dunham
- Data warehousing Fundamentals by PaulrajPonnian, John Willey
- Data mining for Business intelligence: concepts, techniques and applications in Microsoft Excel by G. Shumeli, N R Patel, P.C Bruce, Wiley

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA402	**Advanced Web Technologies**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA402	**Advanced Web Technologies**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme						
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 402	**Advanced Web Technologies**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

- Basic Understanding of Object Oriented Programming
- Basic Understanding of Web Technologies

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO402.1	Study the architecture of Dot Net framework
CEO402.2	Understand the basic principles of C# development
CEO402.3	Learn advanced windows and web development techniques using dotNET

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

MCA402.1	Create UI applications using C#
MCA402.2	Design and develop secure web applications using asp.net according to industry standards
MCA402.3	Define and create custom web services

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Dot Net and C#**	**Introduction to Dot Net Framework** Architecture of Dot NET Framework, CLR-Working and Features,CTS,CLS,Assemblies-Types,Structure and Metadata,GAC **C# Basics** Data Types(Value Types and Reference Types),Control Structures,Operators and Expressions, Arrays	**08**
2	**OOP C#**	**Classes and Objects** Instance Variables, Methods, Constructors, Properties, Access Specifiers,Static members and methods **Inheritance** Levels of Inheritance,Constructor and Inheritance,Polymorphism,Interfaces,Abstract classes,Delegates,Indexers,Sealed Classes,Exception handling **Collections and Generics** Bounded and Unbounded Collections,Generic Programming-Generic classes, Functions, Constraints on Generic Programming	**10**
3	**Databases and C#**	**File Handling** Text Files, Binary Files, String Processing, Serialization and Deserialization **ADO.Net** Connected and Disconnected,Architecture of ADO.Net,Commands,Datasets,Data Readers, Data Adapters,Working with Stored Procedures **LINQ and the ADO.NET EntityFramework** LINQ Introduction, Mapping Your Data Model to an Object Model, Introducing Query Syntax	**08**
4	**Asp.Net Web Applications**	Life cycle of Asp.Net web pages, Role of client side scripting, postback posting and cross page posting, asp.net compilation model, asp.net HTML Controls,Server Controls(basic controls,Calendar,AdRotator,FileUpload,ValidationControls	**08**
5	**Data and State Management in ASP.NET**	ASP.NET Websites with Themes and MasterPages, Data Source Controls, Data Bound Controls, ASP.NET State Management-Client Side and Server Side. ASP.NET and AJAX	**10**
6	**Web Services**	XML,Web Services Architecture, UDDI,SOAP and its Format,WSDL,Create and Consuming XML Web Service-Simple and Databases, WCF- Architecture,End Points, Types of Contracts, Web Applications and Security	**08**

References:

- Beginning Visual C# 2012 Programming, Karli Watson, Jacob Vibe Hammer, Jon D. Reid, Morgan Skinner, Daniel Kemper, Christian Nagel,ISBN: 978-1-118-31441-8,Wrox Publication
- Professional C# 2008,Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner,ISBN: 978-1-118-64321-1 ,Wrox Publication
- Beginning ASP.NET 4.5: in C# and VB,ImarSpaanjaars, ISBN: 978-1-118-31180-6,Wrox Publication
- Professional ASP.NET 4.5 in C# and VB,Jason N. Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, Scott Hanselman, Scott Hunter (Foreword by), ISBN: 978-1-118-31182-0,Wrox Publication
- Murach's ASP.NET 4 Web Programming with C# 2010, Anne Boehm,JoelMurrach,SPD, Murrach Books
- Murach's C# 2015,Anne Boehm and Joel Murach,ISBN 978-1-890774-94-3,Murrach Books
- Murach "s ADO. Net 4 Database Progra
- Pro C# 5.0 and the .NET 4.5 Framework – Andrew Trolsen, APress
- Advance .NET Technology second edition by ChiragPatel- DreamTech Press

Web References:

- MSDN: Learn to Develop with Microsoft Developer Network: https://msdn.microsoft.com/

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA403	**Computer Graphics**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA403	**Computer Graphics**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 403	**Computer Graphics**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic Mathematics

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO403.1	Understand the concepts of output primitives of Computer Graphics.
CEO403.2	Learn 2 D and 3 D graphics Techniques.
CEO403.3	Study various Image Processing techniques

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

MCA403.1	Demonstrate the algorithms to implement output primitives of Computer Graphics.
MCA403.2	Apply 2 D transformation techniques.
MCA403.3	Analyze 3 D transformation techniques.
MCA403.4	Apply image processing techniques.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Computer Graphics**	Introduction to Computer Graphics,Elements of Computer Graphics ,Graphics display systems.	**02**
2	**Output primitives & its Algorithms**	Points and Lines, Line Drawing algorithms :DDA line drawing algorithm, Bresenham's drawing algorithm ,Circle and Ellipse generating algorithms : Mid-point Circle algorithm ,Mid-point Ellipse algorithm ,Parametric Cubic Curves :Bezier curves .Fill area algorithms: Scan line polygon fill algorithm ,Inside-Outside Tests, Boundary fill algorithms, Flood fill algorithms	**15**
3	**2D Geometric Transformations & Clipping**	Basic transformations, Matrix representation and Homogeneous Coordinates, Composite transformation,shear & reflection. Transformation between coordinated systems. Window to Viewport coordinate transformation,Clipping operations – Point clipping Line clipping : Cohen – Sutherland line clipping, Midpoint subdivision,Polygon Clipping:Sutherland – Hodgeman polygon clipping ,Weiler – Atherton polygon clipping	**12**
4	**Basic 3D Concepts & Fractals**	3D object representation methods: B-REP, sweep representations, CSG, Basic transformations,Reflection,shear. Projections – Parallel and PerspectiveHalftone and Dithering technique. Fractals and self-similarity: Koch Curves/snowflake, Sirpenski Triangle	**06**
5	**Introduction to Image Processing**	Fundamental Steps in Digital Image Processing ,Components of an Image Processing System ,Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-Level Resolution	**05**
6	**Image Enhancement Techniques**	Image Enhancement in the Spatial Domain: Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, and Power Law Transformations. Piecewise-Linear Transformation Functions: Contrast stretching, Gray-level slicing, Bit plane slicing. Introduction to Histogram, Image Histogram and Histogram Equalization, Image Subtraction, and Image Averaging	**12**

References:

- Donald Hearn and M Pauline Baker, Computer Graphics C Version -- Computer Graphics, C Version, 2/E, Pearson Education.
- David F. Rogers, James Alan Adams, Mathematical elements for computer graphics , McGraw-Hill, 1990
- Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing (3rd Edition), Pearson Education.
- S. Sridhar-Digital image Processing, Second Edition, Oxford University Press
- Anil K. Jain -Fundamentals of digital image processing. Prentice Hall, 1989

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Elective Subjects

Elective-I
MCA404

Subject Code	Subject Name	Credits
MCA4041	**Entrepreneurship Management**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4041	**Entrepreneurship Management**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4041	**Entrepreneurship Management**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

- Basic knowledge of Project Management & IT in Management.
- Knowledge of Financial Accounting & Management.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4041.1	Be familiar with Entrepreneurship basics, Skills and Qualities of Entrepreneurs.
CEO4041.2	Understand how to design effective and efficient Business Plan for intended users.
CEO4041.3	Understand and Learn various approaches for Woman Entrepreneurship, Business Management and Development.

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

MCA4041.1	Understand the concepts and fundamentals of Entrepreneurship.
MCA4041.2	Analyse the process of Business Idea generation and converting the idea into a Business Model.
MCA4041.3	Identify the Role of Small Scale Industries (SSI) & Institutions Supporting Small Scale Enterprise.
MCA4041.4	Understand the exit strategies and Social Responsibilities.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Foundation of Entrepreneurship**	Concept, Meaning and Definition of Entrepreneur and Entrepreneurship, Importance and Significance of Growth of Entrepreneurial Activity, Concept of Entrepreneur, Traits, Characteristics, Skills and Qualities of Entrepreneurs, Classification and Types of Entrepreneurs, Entrepreneur vs Professional Manager.	**08**
2	**Creating and Starting the Venture**	**Business Idea:** New Business Idea, Pre-selection Process, Sources of Business Idea, Preliminary Research, Business Idea Evaluation, Other Analysis. **Business Plan:** Use of Business Plan, Creating a Business Plan, Types of Business Plan, Description of Business, Management Team, Marketing Plan, Finance, Risk and Contingencies.	**10**
3	**Small Business Enterprise**	Role of Small Scale Industries (SSI), Concept and Definition of Small Scale Industries, Government policy and Development of SSI in India, Growth and Performance of SSI in India, Problems for SSI. **Institutions Supporting Small Scale Enterprise**:Central Level, State Level and Other Agencies, Industry Association. **Setting up a Small Business Enterprise:** Identifying the Business Opportunity**,** Business Opportunity in **O**ther Sectors, Formulating of setting SSI.	**14**
4	**Women Entrepreneurship**	Women Entrepreneurship Defined, Environment, Challenges in the path of Women Entrepreneurship, Strategies for the Development of Women Entrepreneurship, Empowerment of Woman by Entrepreneurship, Grassroots Entrepreneurship through Self Help Groups (SHGs), Institutions supporting Women Entrepreneurship in India, Women Entrepreneurship in India, Case Studies of Successful Women Entrepreneurs.	**08**
5	**Growing and Managing the Venture**	Growth Strategies, Economic Implication of growth, Implications of Growth for the firm, Overcoming Pressures on existing Financial & Human Resources, Overcoming Pressures on Management of Employees & Entrepreneurs' Time, Implication of Firm Growth to the Entrepreneur.	**06**
6	**Exit Strategies and Social Responsibility**	Reasons for Existing, Long-Term Preparation, Short-Term Preparation, Introduction of Social Responsibility, Corporate Social Responsibility(CSR), Dimensions of CSR.	**06**

References

- Vasant Desai, The Dynamics of Entrepreneurial Development and Management, 2015, Himalaya Publishing House.
- Rajeev Roy, Entrepreneurship, Oxford University Press Edition Fourth.

- Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, Sixth Edition, The Mc Graw Hill Company.
- PoornimaCharantimath, Entrepreneurship Development- Small Business Enterprise, Pearson.
- Vasant Desai, Entrepreneurship and Small Business Management, 2009, Himalaya Publishing House.
- Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
- Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
- Entrepreneurial Development: S.S. Kanka, S. Chand & Company.

Web References:

- www.msme.gov.in
- www.womenentrepreneursindia.com
- www.msmetraining.gov.in

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA4042	**Business Infrastructure and Management**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA 4042	**Business Infrastructure and Management**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4042	**Business Infrastructure and Management**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Knowledge of Internet, Web and Network Systems

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4042.1	Study fundamentals of conducting business over the Internet
CEO4042.2	Familiarize with the Infrastructure, Ethics of electronic-business
CEO4042.3	Explore different kinds of business values and managing the change in digital market

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

MCA4042.1	Adopt to transform traditional business into an e-business.
MCA4042.2	Identify the Infrastructure and Security issues related to e-business
MCA4042.3	Understand the current scenarios of digital world and applications of it

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**The world of E – Business**	What Is E-Business?, Characteristics Of E-Business, Categories Of E-Business (B2B, C2B, B2C, C2C), Elements Of E-Business, E-Business Roles And Challenges, E-Business Requirements, Impact Of E-Business, Inhibitors Of E-Business.	**04**
2	**E-business Strategies**	What Is E-Business Strategies, Strategic Positioning, Levels Of E-Business Strategies, The Changing Competitive Agenda: Business And Technology Drivers, The Strategic Planning Process, Strategic Alignment, The Consequences Of E – Business: Theoretical Foundations, Success Factors For Implementation Of E – Business Strategies.	**06**
3	**E-Business Models**	Pressure Forcing Business Changes, Business Models – Definition, Classification Of Business Models, Networked Business Models.	**06**
4	**The digital firm – Electronic business / Electronic commerce**	**Electronic Business, Electronic Commerce And The Emerging Digital Firm:** Internet Technology And The Digital Firm, New Business Models & Value Propositions **Electronic Commerce:** Categories Of Electronic Commerce, Customer – Centered Retailing, **Windows On Management:** Customer Communities Become Product Development Tools, B2B Electronic Commerce, New – Efficiencies And Relationships, **Window On Organization:**Covisint: The Vision And The Reality, E – Commerce Payment Systems. **Electronic Business & The Digital Firm:** How Intranets Support Electronic Business, Intranets & Group Collaboration, Intranet Applications For E – Business, Supply Chain Management & Collaborative Commerce. **Management Challenges And Opportunities:** Unproven Business Models, Business Process Change Requirements, Legal Issues, Trust, Security & Privacy, MIS In Action: Manager's Toolkit: Digitally Enabling The Enterprise: Top Questions To Ask, Make IT Your Business.	**10**
5	**Digital / Electronic Markets & Solutions**	Electronic Markets Defined, Functions Of Electronic Markets, How Do Electronic Markets Differ From Traditional Market?, Effects Of Electronic Markets, Electronic Market Success Factors, E – Market Technology Solutions.	**06**
6	**E-Business technological Infrastructure and Management**	Technical e-Business Challenges, Basic Infrastructure, Web Technologies and Application, Collaborative Technology, The role of enterprise Information Systems in e-Business. **The new IT Infrastructure for the Digital Firm:** Enterprise Networking and Internetworking, Standards and connectivity for the Digital Integration, Technology and Business Standards. **Support Technology for Electronic Business:** Web Server and Electronic Commerce servers, How to Integrate the wireless Web into Business strategy, Customer Tracking and Personalization Tools, Web content Management Tools, Web site Performance	**12**

		Monitoring Tools, Web Hosting Services, The Challenge of Managing the IT Infrastructure and Solutions.	
7	**Ethical & Social Issues in the digital firm**	**Understanding ethical and social issues related to systems:** Model For Thinking About Ethical, Social And Political Issue, Moral Dimensions Of The Information Age, Key Technology Trends That Raise Ethical Issue. **Ethics in an information society:** Basic Concepts:Responsibility, Accountability And Liability, MIS In Actions: Manager's Toolkit: How To Conduct An Ethical Analysis, Candidate Ethical Principles, Professional Codes Of Conduct, Some Real World Ethical Dilemmas. **The moral dimensions of information Systems:** Information Rights: Privacy & Freedom In The Internet Age, **Window On Organizations:** Privacy For Sale, Property Rights: Intellectual Property, Accountability, Liability And Control, System Quality: Data Quality And System Errors, Quality Of Life: Equity, Access And Boundaries, **Window On Management:** Alberta Narrows Its Digital Divide, Management Actions: Corporate Code Of Ethics, Make IT Your Business.	**08**

References:

- Michael P. Papazoglou , Pieter M.A. Ribbers "E-Business Organizational and Technical Foundations,Wiley India Edition.
- Waman S Jawadekar, Management Information Systems- A Digital-Firm perspective ,4th edition,TMH
- H Albert Napier,Ollie rivers,Stuart Wagner, JB Napier 2ed, "Creating a Winning E Business"Cengage Learning India Edition.
- Kenneth C Laudon, Jane P.Laudon "Managing The Digital Firm , Eighth Edition, Pearson Education.
- Kenneth C Laudon, Carol GuercioTraver "e-commerce Business, technology, Society",4ed,Pearson
- Dave Chaffey" E-Business and E-commerce Mnagement"3ed,Pearson.

Assessment:

Internal:

Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests. Besides this, students in a group of 3 or 4 have to present a case study compulsorily related to electronic / digital Business likee-chaupal/e-governance /e-tourism/e-Learning/e-real estate/e-Media/ Impact of e-Business on society etc.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA4043	**Enterprise Resource Planning**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4043	**Enterprise Resource Planning**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme						
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4043	**Enterprise Resource Planning**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Knowledge of Information Technology, Business System Management, Software and Networking

Course Educational Objectives (CEO): At the end of the course, the students will be able to

MCA4043.1	Study technical aspects of Enterprise Resource Planning **(**ERP) with its lifecycle.
MCA4043.2	Identify the functionality in an ERP system
MCA4043.3	Understand tools and methodology used for designing ERP for an Enterprise

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

MCA4043.1	Conceptualize the basic structure of ERP
MCA4043.2	Identify implementation strategy used for ERP
MCA4043.3	Apply design principles for various business module in ERP
MCA4043.4	Apply different emerging technologies for implementation of ERP

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Enterprise Resource Planning (ERP)**	Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system	**08**
2	**ERP Implementation Lifecycle**	Project Preparation, Initial Costing, Requirement Engineering, ERP Solution Selection, Technical Planning, Change Management and Training Plan, Implementation and Deployment Planning, Configuration, Custom Coding, Final Preparation, Go-live	**08**
3	**ERP and Related Technologies**	Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM), Electronic Data Interchange (EDI)	**08**
4	**ERP Manufacturing Perspective**	MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP - Distributed Requirement Planning, PDM - Product Data Management	**06**
5	**ERP Modules**	Finance, Plant Maintenance, Quality Management, Materials Management,	**08**
6	**Benefits of ERP**	Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality, Costs, Improved Information Accuracy and Design-making Capability	**06**
7	**Introduction to ERP tools**	OpenERP JD Edwards-Enterprise One Microsoft Dynamics-CRM Module SAP	**08**

References:

- Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
- Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
- Enterprise Resource Planning - Ravi Shankar & S. Jaiswal ,Galgotia.
- Enterprise Resource Planning : Concepts and Practices by Vinod Kumar Garg, N. K. Venkitakrishnan
- ERP a Managerial Perspective by S Sadagopan
- Guide to Planning ERP Application, AnnettaClewwto and Dane Franklin, McGRaw-Hill, 1997
- The SAP R/3 Handbook, Jose Antonio, McGraw – Hill
- E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : A Practical Roadmap For Success By Dr. Ravi Kalakota
- Enterprise Resource Planning, A Managerial Perspective by Veena Bansal, PEARSON

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any four from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA4044	**Ethics & CSR**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4044	**Ethics & CSR**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA4044	**Ethics & CSR**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic knowledge of Organizational behavior& Corporate Governance

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4044.1	Acquire knowledge of Ethics in the modern era
CEO4044.2	Understanding of Ethical decision making approaches.
CEO4044.3	Understand the scope and complexity of Corporate Social responsibility in the global and Indian context.

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

MCA4044.1	Understand ethical theories and ethics in profession.
MCA4044.2	Analyze global issues in ethics
MCA4044.3	Apply Ethical Code, Audit and living in real world.
MCA4044.4	Analyze Corporate Social Responsibility and its framework.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Basic Concepts in Ethics & Ethical Theories**	Introduction, Terminology, Personal Ethics, Professional Ethics, Life skills, Basic Ethical Principles, Moral Development,Theories-Piaget's Theory, Kohlberg's Theory, Elliot Turiel's Theory, Gilligan's Theory, Comparison of Moral Development Theories. Classification of Ethical Theories, Some basic Theories	**10**
2	**Global Issues in Ethics**	Introduction, Current Scenarios, Business Ethics, Environmental Ethics, Computer Ethics, Media Ethics, Bioethics, Research Ethics, Intellectual Property Rights, Professionals & Ethics.	**08**
3	**Ethical Codes**	Need for Ethical Codes, Sample codes, Codes from Other Professions, Corporate Codes, Implementation of codes, Limitations of codes.	**08**
4	**Ethics Audit & Ethical Living**	Need for Ethics audit, Ethics Profiles of Organizations, Considerations for Ethics Audit, Ethics standards and Benchmarking, Procedure for Ethics audit, Ethics audit Report.Ethical Living, Ethical living for Professionals.	**08**
5	**Understanding Corporate Social Responsibility (CSR), Evolutions of Company & CSR Role of various institutions in CSR**	Introduction, Understanding CSR, History of CSR in India. Theories of corporate Governance, Importance of CSR in Corporate Governance, The Social Impact. Introduction, Role of Government, Role of NGO'S & Not-for-profit Organizations, Role of Educational Institutions, Role of the Media.	**10**
6	**Framework for rating CSR & Global CSR.**	Understanding CSR ratings, available Accepted Rating Frameworks, Structure of BITC CR Index, Rating Criteria and basic structure of the rating process. Study of Sample Rating Framework for Corporate. Multinational companies, challenges of multinationals, country specific CSR Initiatives.	**08**

References:

- Professional Ethics,R.Subramanian, Oxford Higher Education.
- Corporate Social Responsibility, MadhumitaChatterji, Oxford Higher Education
- Business Ethics and Corporate Governance, A.C. Fernando, Pearson 2nd Edition
- Corporate Ethics, Governance, and Social Responsibility: Precepts and Practices ,Fernando, Pearson

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Elective-II
MCA405

Subject Code	Subject Name	Credits
MCA4051	**Digital Forensics**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4051	**Digital Forensics**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4051	**Digital Forensics**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Information Security

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4051.1	Understand the fundamental of forensics
CEO4051.2	Have in depth knowledge of relationship between IT and Forensics
CEO4051.3	Study different aspects of digital evidences

Course Outcomes: At the end of the course, the students will be able to:

MCA4051.1	Develop computer forensic awareness
MCA4051.2	Utilizing the knowledge for investigations in order to solve computer crime
MCA4051.3	Perform best practices for incidence response
MCA4051.4	Apply computer forensic tools for investigation

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction**	Introduction of Cyber Crime, Computer roles in Crime, Introduction to Digital Forensics and its uses. Forensics Evidence, Collection, Processing and the phases of forensics investigation, Types of Computer Forensics	**06**
2	**Data Recovery**	Encryption and Decryption, Recovery deleted files, Identifying false images and Steganography methods for media data including text, image and audio data	**08**
3	**Digital Evidence Controls**	Uncovering attacks that evade detection by event viewer and task manager. Memory image acquisition techniques and their limitations	**08**
4	**Network Forensics**	Different attacks in network, collecting and analyzing network based evidence in windows and Unix environment, Email forensics for standard protocols	**06**
5	**Mobile Phone and Android Forensics**	Crime and mobile phones, evidences, forensic procedures, files present in SIM Card, Device data, External memory dump and evidences in memory card, Android forensic fundamental, Data extraction techniques, screen lock bypassing techniques	**08**
6	**Cloud Forensics**	Fundamentals of cloud forensics, Cloud crimes, Uses of cloud forensics and its challenges, Interaction of Email system with local and cloud storage	**08**
7	**Real forensic Case and Its Tools**	Processing a complete forensic case and preparing a forensic report and Introduction of some forensic tools- Helix, FTK, Autopsy and FIRE	**08**

Reference:

- Digital Forensics with open source tools. Cory Altheide and Harlan Carvey, ISBN: 978-1-59749-586-8,Elsevier Publications, April 2011
- Digital Evidence and Computer crime 3rd Edition: Forensics Science, Computers and the Internet by Eoghan Casey, 2011
- Computer Forensic and Cyber Crime: An Introduction 3rd Edition by Marjie T. Britz, 2013
- Network Forensics: Tracking Hackers through Cyber Space, Sherri Davidoff, Jonathan Ham Prentice Hall 2012
- Android Forensics: Investigation and Security by Andrew Hogg, Publisher – Synergy
- Practical Mobile Forensics: Satish Bommisetty,RohitTamma and Heather Mahalik, Pack Publishing LTD 2014, ISBN-978-1-78328-831-1

Web References:

1. Computer Forensics World http://www.computerforensicsworld.com/
2. Computer Forensic Services http://www.computer-forensic.com
3. Digital Forensic Magazine http://www.digitalforensicsmagzine.com
4. Journal of Digital Forensic Practice http://www.tandf.co.uk/15567281

5. http://cloudtimes.org/2012/11/05/the-basics-of-cloud-forensics/

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA4052	**Simulation & Modelling**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4052	**Simulation and Modelling**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
MCA 4052	**Simulation and Modelling**	Test1 (T1)	Test2 (T2)	Average of (T1 & T20					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Overview of Probability, Statistics and Discrete Mathematics and basics of Computers.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4052.1	Understand the basic system concepts and definitions of the types of system.
CEO4052.2	Provides techniques to model and simulate each system.
CEO4052.3	Ability to analyze the system and make use of information to improve its performance.

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

MCA4052.1	Apply functional modeling to model the activities of a static system.
MCA4052.2	Understand the behavior of a dynamic system and create a model for a dynamic system.
MCA4052.3	Simulate the real systems

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Simulation**	What is modeling and Simulation: History, Application areas, Advantages and Disadvantages, Role of modeling and simulation for Problem solving, Types of simulation models and examples: static (Monte Carlo simulation and its application to industries), dynamic (Bank), deterministic (arrivals at scheduled appointment time), stochastic (random arrivals and service time), Discrete event simulation (queuing system), continuous (communication and traffic system). Steps in simulation study. Uses of simulation with examples(Experimentation, experience, ethics, human interaction).	**04**
2	**Description and solutions of simulation examples**	Simulation of Queuing system (G/G/1, D/D/1 ,…, M/G/1, M/M/1) characteristics, notation, Measures of performance of Queuing system, example of single channel of Queue, the Able Baker call center problem.Simulation of inventory system (News Paper seller problem), Other examples: Reliability problem, Use of random normal numbers for simulation, project simulation, Lead Time Demand, Job Shop Model.	**12**
3	**Simulation Models using Random Numbers and Variates**	Simulation Examples based on statistical distributions. Discrete distributions, Continuous distributions, Poisson process.Random- Number Generation: Properties of Random Numbers, Generation of Pseudo- Random Numbers, Techniques for Generating Random Numbers, Tests for Random Numbers. Random Variate Generation:Inverse Transformation Technique –Uniform Distribution, Exponential Distribution, Weibull Distribution. Convolution Method for Erlang Distribution, Acceptance-Rejection Technique – Poisson Distribution.	**12**
4	**Input and Output Analysis**	**Input Models with Data:** Data Collection, Identifying the Distribution with Data - Parameter Estimation, Goodness of Fit Tests: Chi-Square Test, Kolmogorov-Smirnov Test. Selecting Input Models without Data , Time-Series Input Models **Output Analysis:** Stochastic Nature of Output Data - Types of Simulation with respect to Output Analysis- Measures of Performance and their Estimation (Point Estimation, confidence Interval Estimation). Output Analysis for Terminating Simulations (Confidence Interval Estimation)Output Analysis for Steady-State Simulation.(Error estimation)	**12**
5	**Verification and Validation**	Model Building, Verification and Validation; Verification of Simulation Models - Calibration and Validation of Models:- Face Validity, Validation of Model Assumptions, Validating Input-Output Transformations - Input-Output Validation using Historical Input Data, Input-Output . Validation using a Turing	**06**

		Test. Optimization via simulation examples.	
6	**Modelling and Simulation of Real World Problems**	Simulation of manufacturing systems, Simulation of computer systems, Simulation of supermarket. Simulation of Transportation model, business model, Medical models, Social Science models.	**06**

Reference:

- J. Banks, J. S.Carson II and B. L. Nelson,, "Discrete-Event System Simulation", 2nd Edition, Prentice Hall of India, New Delhi, 1995.
- Simulation & Modelling- Jain, Wiley -Dreamtech
- J. A. Sokolowski, C.M. Banks, "Principles of Modeling and Simulation: A multidisciplinary Approach", John Wiley & Sons Publications, edited 2011.
- Averill M.Law and W.DavidKelton, "Simulation Modeling& Analysis", 2nd Edn., Tata McGraw Hill, 1991.
- Geoffrey Gardon, "System Simulation", 2nd Edn.,Printice Hall of India, 1992.
- NarsinghDeo, " System Simulation with Digital Computers", Prentice Hall of India, 1979.

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA4053	**Next Generation Networks**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA4053	**Next Generation Networks**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4053	**Next Generation Networks**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Computer Networks

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4053.1	Relate the paradigm shift from circuit switched network to packet switched network.
CEO4053.2	Understand the core technologies, and architectures of the Next Generation Networks
CEO4053.3	Summarize technology options for Multi-Service Networks

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

MCA4053.1	Evaluate the importance of packet switching for NGN
MCA4053.2	Analyze and differentiate various architectures of a next generation network (NGN)
MCA4053.3	Comprehend the multiple services offered by NGN

Syllabus

Sr. No	Module	Detailed Contents	Hrs
1	**Introduction**	Changes, Opportunities and Challenges, Technologies, Networks, and Services, Requirements for NGN, Next Generation Network Concept, Next Generation Society	**08**
2	**Next Generation Technology**	Technologies influencing change, IP Networks (Migration from circuit Switching to Packet Switching), building blocks for NGN, Wireline NG Technologies: Fiber to Premises, Long-Haul Managed Ethernet, Wireless NG Technologies: Broadband Bluetooth & ZigBee, Long Term Evolution, VOIP, Multi service Flexible Networks architecture. VPNs, ITU - NGN Architecture, Numbering, naming and addressing in NGN	**10**
3	**IMS and Convergence Management**	IMS Architecture, IMS Services : Push to Talk over cellular Service , IMS Based FMC Services	**08**
4	**IPTV &HbbTV**	Introduction, Architecture of NGN Based IPTV, NGN Based IPTV Services, Protocols Used for IPTV, HbbTV (Hybrid Broadcast Broadband TV) Services, HBB–NEXT, Multiple-User Environment	**08**
5	**Next Generation Multiservice Technology**	MPLS , MPLS services and components , MPLS &QoS, overview of VPN, layer2 VPN, layer 3 VPN	**08**
6	**NGN Services**	Software- Based Business Services, High- Definition Voices, Three Dimensional Television, Mobile and Manages Peer-to Peer Service, Converged/ Personalized / Interactive Multimedia Services, Grand-Separation for Pay-per-Use Service, Consumer and Business-Oriented Apps Storefront	**10**

Reference:

- Thomas Plavyk, “Next generation Telecommunication Networks, Services and Management”, Wiley & IEEE Press Publications, 2012
- Next Generation Networks – NGN, Module 1: ITU NGN standards and architectures
- NGN Architecture: Generic Principles, Functional Architecture, and Implementation Keith Knightson, Consultant, Naotaka Morita, NTT Corporation, Thomas Towle. Lucent Technologies — Bell Laboratories, IEEE Communications Magazine • October 2005
- Azhar Sayed , Monique Morrow MPLS and Next Generation Networks:Foundations for NGN andEnterprise Virtualization**",** Cisco Press

Assessment:

Internal:

Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA 4054	**Artificial Intelligence and Soft Computing**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	TW	Tut.	Total
MCA 4054	**Artificial Intelligence and Soft Computing**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 4054	**Artificial Intelligence and Soft Computing**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Students should have knowledge of SET theory, SET relations and Probability.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO4054.1	Identify and describe problems that are amenable to solution by AI methods.
CEO4054.2	Study appropriate soft computing techniques for problem solving
CEO4054.3	Study optimization techniques based on soft computing approach

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

MCA4054.1	Understand various AI concepts
MCA4054.2	Solve the problems using neural networks techniques.
MCA4054.3	Apply fuzzy logic techniques to find solution of uncertain problems.
MCA4054.4	Analyze the genetic algorithms and their applications

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to AI**	**Artificial Intelligence** : Role of AI in engineering, AI in daily life, Intelligence and Artificial Intelligence, Different task domains of AI, Programming methods, Limitations of AI **Intelligent Agent:** Agent, Performance Evaluation, task environment of agent, Agent classification, Agent architecture	**05**
2	**Problem Solving**	**Problems, problem spaces and search:** Define the problem as a state space search, Production systems, Problem characteristics, Production system characteristic, Issues in design of search program **Search Techniques:** DFS, BFS, Hill Climbing	**06**
3	**Knowledge Representation**	**Knowledge Representation**: Need to represent knowledge, Knowledge representation with mapping scheme, Properties of good knowledge-based system, Knowledge representation issues, AND-OR graph, Types of knowledge	**09**
4	**Concepts of Soft Computing**	**Soft Computing:** Hard computing Vs Soft Computing, Soft computing constituents – ANN, Fuzzy Logic, GA Applications of Soft Computing	**02**
5	**Neural Network**	**Artificial Neural Network:** Introduction,Fundamental Concept, Artificial Neural Network, Brain vs. Computer - Comparison Between Biological Neuron and Artificial Neuron, Basic Models of Artificial Neural Network **Supervised Learning Network**-Linear Separability, Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Back-Propagation Network. **Unsupervised Learning Networks**- MaxNet	**12**
6	**Fuzzy Logic**	**Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets:**Introduction to Fuzzy Logic, Classical Sets (Crisp Sets),Fuzzy Sets **Classical Relations and Fuzzy Relations:** Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relations **Membership Functions:** Introduction, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments **Defuzzification:** Introduction, Lambda-Cuts for Fuzzy Sets (Alpha-Cuts), Lambda-Cuts for Fuzzy Relations, Defuzzification Methods	**10**
7	**Fuzzy Inference System**	**Fuzzy Inference System**: Truth Values and Tables in Fuzzy Logic, Fuzzy Propositions, Formation of Rules, Decomposition of Rules (Compound Rules), Aggregation of Fuzzy Rules, Fuzzy Inference Systems (FIS)- Construction and Working Principle of FIS, Methods of FIS, Overview of Fuzzy Expert System	**04**
8	**Genetic Algorithm**	**Genetic Algorithm**: Basic concepts, Difference between genetic algorithm and traditional methods, Simple genetic algorithm, Working principle, Procedures of GA, Genetic operators-reproduction, Mutation, crossover.	**04**

References:

- Artificial Intelligence, 3rd Edition, Elaine Rich, Kevin Knight, S.B. Nair, Tata McGraw Hill.
- Artificial Intelligence and Soft Computing for Beginners- Anandita Das, ShroffPublication.
- Dr. S. N. Sivanandam and Dr. S. N. Deepa,"Principles of Soft Computing "John Wiley
- S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
- Kumar Satish, "Neural Networks" Tata McGraw Hill
- Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
- Search, Optimization & Machine Learning by *David* E. *Goldberg*.

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAL401	**Advanced Web Technology and Data Mining and Business Intelligence Lab (AWT and DMBI Lab)**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAL401	**Advanced Web Technology and Data Mining and Business Intelligence Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA L401	**Advanced Web Technology and Data Mining and Business Intelligence Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:

- Basic Knowledge of Object Oriented Programming concepts
- Basic Understanding of Database Systems

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOL401.1	Learn advanced windows and web development techniques using dotNET
CEOL401.2	Understand Business Intelligence and Data Mining techniques
CEOL401.3	Prepare Business Intelligence applications using Web Technologies.

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

MCAL401.1	Develop Windows forms applications and Web Applications using Dot NET Technologies
MCAL401.2	Apply Data warehousing and mining techniques.
MCAL401.3	Design and implement web enabled BI application for industry.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Dot Net and C#**	• Basic Windows Forms Applications • Windows Forms Applications using Control Structures and Operators • Advanced Windows Forms Controls	**04**
2	**OOP C#**	• Programs using Classes and Objects • Programs based on Inheritance • Programs using Static and Constant • Programs using Interfaces • Programs using Abstract Classes • Programs on Collections • Designing Generic Classes and Methods	**10**
3	**Databases and C#**	• Text File Handling • Text Editing Application • Binary File Handling • Database Connectivity in Connected Manner • Database Connectivity in Disconnected Manner • LINQ with Object Data Source • LINQ with DataSet	**08**
4	**Asp.Net Web Applications**	• Web Applications using Web Server Controls • Web Applications using advanced Web Server Controls • ASP .NET Applications using Web Forms • ASP.NET Applications using MVC	**08**
5	**Data and State Management in ASP.NET**	• ASP.Net Web Applications managing States • Web Applications using SQL Data Source • Web Applications using Connected and Disconnected database Connectivity • Web Applications using ADO.NET Entity Framework • Web Applications using jquery and database Connectivity • Web Applications using ASP.NET Ajax • Websites using Master Pages and Themes	**10**
6	**Web Services**	• Creating and Consuming a XML Web Service-Simple and Database • Creating and Consuming a WCF service – Simple and Database • Designing Secure Web Application • Deploying web Site	**06**
7	**Data Warehousing**	**Data Warehousing using Oracle** • Setting Up and Starting Warehouse Builder • Introducing OWB Architecture and Configuration • Defining Source Metadata • Ensuring Data Quality Using Data Profiling • Defining Staging Metadata and Mapping Tables • Deriving Data Rules and Running Correction Mappings	**06**

		• Defining a Relational Dimensional Model • Handling Slowly Changing Dimensions **OLAP with Oracle** • Analytical Queries • Grouping Functions • Windowing Functions • RollUp and Cube	
8	**Data Mining**	**Data Mining Using Weka/R Miner** • Introducing Weka/R Miner • The Data Mining Process • Using Classification Models • Using Regression Models • Using Clustering Models • Performing Market Basket Analysis • Performing Anomaly Detection • Deploying Data Mining Results	**08**
9	**BI Tools**	**Open Source BI Tools** • Preparing Reports • Preparing Dashboards • Preparing Balanced ScoreCards • Analysis of Reports	**08**
10	**Mini Project**	**Mini Project** A Mini Projects based on Data Mining and Business Intelligence Techniques using advanced Web Technologies.	**10**

References:

- Beginning Visual C# 2012 Programming, Karli Watson, Jacob Vibe Hammer, Jon D. Reid, Morgan Skinner, Daniel Kemper, Christian Nagel,ISBN: 978-1-118-31441-8,Wrox Publication
- Professional C# 2008,Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, ISBN: 978-1-118-64321-1,Wrox Publication
- Beginning ASP.NET 4.5: in C# and VB,ImarSpaanjaars, ISBN: 978-1-118-31180-6,Wrox Publication
- Professional ASP.NET 4.5 in C# and VB,Jason N. Gaylord, Christian Wenz, Pranav Rastogi, Todd Miranda, Scott Hanselman, Scott Hunter (Foreword by), ISBN: 978-1-118-31182-0,Wrox Publication
- Murach's ASP.NET 4 Web Programming with C# 2010, Anne Boehm,Joel Murrach,SPD, Murrach Books
- Murach's C# 2015,Anne Boehm and Joel Murach,ISBN 978-1-890774-94-3,Murrach
- Murach "s ADO. Net 4 Database Progra
- Pro C# 5.0 and the .NET 4.5 Framework – Andrew Trolsen, APress
- Advance .NET Technology second edition by ChiragPatel- DreamTech Press

Web References:

- MSDN: Learn to Develop with Microsoft Developer Network: https://msdn.microsoft.com/
- www.weka.org, www.oracle.comwww.pentahobi.com

Subject Code	Subject Name	Credits
MCA L402	**Computer Graphics and Image Processing Lab**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut.	Total
MCA L402	**Computer Graphics and Image Processing Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA L402	**Computer Graphics and Image Processing Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:

- Understanding of Object Oriented Programming Language
- Knowledge of Algorithms

Course Educational Objectives (CEO): At the end of the course, the students will be able to:

CEOL402.1	Understand the concepts of output primitives of Computer Graphics.
CEOL402.2	Learn 2 D and 3 D graphics Techniques.
CEOL402.3	Study various Image Processing techniques

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

MCAL402.1	Implement the algorithms to draw output primitives of Computer Graphics.
MCAL402.2	Implement 2D transformations
MCAL402.3	Implement 3D transformations
MCAL402.4	Implement various image processing techniques.

Syllabus:

Sr. no	Module	Detailed Contents	Hours
01	**Introduction**	Introduction to graphics coordinates system and demonstration of simple inbuilt graphic functions	2
02	**Output primitives & its Algorithms**	Implementation of line generation A. A. DDA line B. Bresenhams line C. application of Line drawing algos.	6
03	**Output primitives & its Algorithms**	Implementation of circle drawing A. Midpoint circle B. application of Circle drawing algos.	4
04	**Output primitives & its Algorithms**	Implementation of ellipse drawing A. Midpoint Ellipse	4
05	**Output primitives & its Algorithms**	Implementation of curve drawing A. Bezier Curve	2
06	**Output primitives & its Algorithms**	Implementation of filling algorithms A. Boundary fill B. Flood fill C. Scan line D. application of Circle drawing algos.	8
07	**2D Geometric Transformations & Clipping**	Implementation of two dimensional transformations A. Translation, Rotation & Scaling B. Shear & Reflection	6
08	**2D Geometric Transformations & Clipping**	Implementation of clipping algorithms A. Cohen Sutherland Line clipping B. Midpoint Subdivision C. Sutherland Hodgeman Polygon Clipping	10
09	**Basic 3D Concepts & Fractals**	Implementation of 3D Transformations (only coordinates calculation)	2
10	**Basic 3D Concepts & Fractals**	Implementation of fractal generation A. Koch curve/Snowflake B. Sirepenski Triangle	6
11	**Introduction of Animation**	Implementation of animation programs (using basic inbuilt Graphical functions)	4
12	**Image Enhancement Techniques**	Implementation of Basic Intensity Transformations A. Image negative B. Log transformation C. Power law Transformation	6
13	**Image Enhancement Techniques**	Implementation of Piecewise-Linear Transformation Functions A. Contrast Stretching B. Grey level Slicing C. Bit plane slicing	8
14	**Image Enhancement Techniques**	Implementation of histogram equalization A. Image histogram & histogram	10

		Equalization B. Image Subtraction C. Image averaging	

Reference:

- Donald Hearn and M Pauline Baker, Computer Graphics C Version -- Computer Graphics, C Version, 2/E, Pearson Education.
- David F. Rogers, James Alan Adams, Mathematical elements for computer graphics , McGraw-Hill, 1990
- Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing (3rd Edition), Pearson Education.
- S. Sridhar-Digital image Processing, Second Edition, Oxford University Press
- Anil K. Jain -Fundamentals of digital image processing. Prentice Hall, 1989

Subject Code	Subject Name	Credits
MCAL403 Activity Lab	**Soft Skills Development**	**02**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCAL403 Activity Lab	**Soft Skills Development**	--	**02**	--	--	**02**	--	**02**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA L403 Activity Lab	**Soft Skills Development**	--	--	--	--	**50**	--	--	**50**

Pre-requisites: ----

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOL403.1	To provide essential professional skills needed to make a positive impact on work and social lives
CEOL403.2	Understand the corporate culture and adapt to various situations
CEOL403.3	Improve their etiquettes, interpersonal skills and professional image

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

MCAL403.1	Develop skills in communication, business correspondence, presentations, group discussions and interviews
MCAL403.2	Apply valuable strategies and interpersonal skills thereby making themselves more productive and better capable to lead others
MCAL403.3	Understand the importance of teamwork and learn to perform to the best of their ability, both individually and as team players

Syllabus

Sr. No	Module	Detailed Contents	Hrs
1	**Soft Skills Introduction**	Soft-Skills Introduction What are Soft Skills? Significance of Soft-Skills – Soft-Skills Vs. Hard Skills - Selling Soft- Skills – Components of Soft Skills – Identifying and Exhibiting Soft-Skills	**01**
2	**Communication**	Concept and meaning of communication, methods of communication, verbal and non-verbal communication, barriers to communication, techniques to improve communication. Communication in a business organization: Internal (Upward, Downward, Horizontal, Grapevine). External Communication, 7 C's of communication. Active Listening, Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening Practical (Role plays, case studies)	**02**
3	**Written Business Communication**	Written Communication: Principles of Correspondence, language and style in official letter (full block format, modified block format), Business letters (enquiry to complaints and redressal), Application letter, CV writing, , E-mail etiquette, Documentation of Meetings, Notice, Agenda, Minutes of Meetings. Practical (Practice on CV, Business Letters, Applications, Notice, Agenda, Minutes of Meetings)	**04**
4	**Presentation Skills**	Presentation techniques, Planning the presentation, Structure of presentation, Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management. Visual aids. Practical - Presentation by students in groups of maximum 3 on Organizational Behavior topics allocated by faculty. Topics have to cover – 1. Personality: Meaning, Personality Determinants, Traits, Personality types and its, impact on career growth, 2. Personality and Values, Perception and Individual Decision Making. 3. Diversity in Organizations 4. Attitude: Meaning, Components of Attitude, changing attitude and its impact on career growth 5. Motivation 6. Goal setting: SMART (Specific, Measurable, Attainable, Realistic, Timely) Goals, personal and professional goals 7. Time Management. 8. Learning in a group, Understanding Work Teams, Dynamics of Group Behavior, Techniques for effective participation 9. Leadership 10. Emotional intelligence	**10**
5	**Effective Public Speaking**	Public Speaking, Selecting the topic for public speaking, Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, Delivering the speech Practical (Extempore)	**03**
6	**Group Discussions**	Group Discussion Skills, Evaluation components, Do's and Don'ts. Practical (Group Discussions)	**03**
7	**Interview**	Interview Techniques, Pre-Interview Preparation, Conduct during	**03**

	Techniques	interview, Verbal and non-verbal communication, common mistakes. Practical (Role plays, mock interviews)	

Reference:

- Business Communication (Revised Edition),Rai& Rai , Himalaya Publishing House.
- Soft skills: an integrated approach to maximise Personality, Chauhan &Sharma,Wiley India publications.
- Business Communication: A practice oriented approach, Kalia and Shailja Agarwal.
- Business Communication – Meenakshi Raman, Prakash Singh, Oxford Publication
- Stephen Robbins & Judge Timothy: Organization Behavior, Pearson Education
- K. Aswathappa – Organizational Behavior: Text, cases & games, Himalaya Publishing House.
- Pareek, Udai, Understanding Organizational Behaviour, Oxford University Press, New Delhi.

Assessment:

Internal:

Internal term workwould consist of

1. A written examination of 20 marks
2. Continuous evaluation of 30 marks would be done by internal faculty on the basis of student participation in all practical activities during entire semester.

Program Structure for
Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester V

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA501	Wireless and Mobile technology	04	--	--	04	--	--	04
MCA502	Advanced Distributed Computing	04	--	--	04	--	--	04
MCA503	User Experience Design	04	--	--	04	--	--	04
MCADLE504	Elective 1 (Departmental level)	04	--	--	04	--	--	04
MCAILE505	Elective 2 (Institutional Level)	04	--	--	04	--	--	04
MCAL501	Mobile Application and User experience Design Lab	--	06	--	--	03	--	03
MCAL502	Open Source System For ADC Lab	--	06	--	--	03	--	03
MCAPR501	Mini Project	--	--	--	--	--	--	02
Total		**20**	**12**	**--**	**20**	**06**		**28**

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test 1	Test 2	Avg					
MCA501	Wireless and Mobile technology	20	20	20	80	--	--	--	100
MCA502	Advanced Distributed Computing	20	20	20	80	--	--	--	100
MCA503	User Experience Design	20	20	20	80	--	--	--	100
MCA DLE504	Elective 1 (Departmental level)	20	20	20	80	--	--	--	100
MCA ILE505	Elective 2 (Institutional Level)	20	20	20	80	--	--	--	100
MCA L501	Mobile Application and User experience Design Lab	--	--	--	--	25	50	25	100
MCA L502	Open Source System For ADC Lab	--	--	--	--	25	50	25	100
MCAPR501	Mini Project	--	--	--	--	25	--	25	50
Total		**100**	**100**	**100**	**400**	**75**	**100**	**75**	**750**

Program Structure for

Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Elective for Semester V

SEM V – Elective 1- Department Level Elective	
Course Code	**Course Name**
MCADLE5041	Big Data Analytics
MCADLE5042	Machine Learning
MCADLE5043	Internet of Things
MCADLE5044	Multimedia System Design
SEM V – Elective 2 - Institute Level Elective	
Course Code	**Course Name**
MCAILE5051	Intellectual property Rights and Patents
MCAILE5052	Research Methodology
MCAILE5053	Management Information System
MCAILE5054	Green Computing

SEMESTER V

Subject Code	Subject Name	Credits
MCA501	**Wireless and Mobile Technology**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract	Tut	Total
MCA501	**Wireless and Mobile Technology**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
MCA 501	**Wireless and Mobile Technology**	Test1(T1)	Test2(T2)	Average of T1 & T2					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic knowledge of networks and communication

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO501.1	Learn the concepts of wireless communication and mobile networks
CEO501.2	Identify different wireless technologies and its applications
CEO501.3	Acquire knowledge on generation of cellular networks and its standards used

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

MCA501.1	Understand the concept of cellular communications, advantages and its limitations
MCA501.2	Compare the various wireless technologies and its applications
MCA501.3	Apply the appropriate technology in the applications

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Wireless Technology Fundamentals**	Introduction to Mobile and wireless communications, Overview of radio transmission frequencies, Signal Antennas, Signal Propagation, Multiplexing – SDM,FDM, TDM,CDM, Modulation – ASK,FSK,PSK, Advanced FSK, Advanced PSK, OFDM, Spread Spectrum – DSSS,FHSS, Wireless Transmission Impairments – Free Space Loss, Fading, Multipath Propagation, Atmospheric Absorption, Error Correction – Reed Solomon, BCH, Hamming code, Convolution Code (Encoding and Decoding)	**08**
2	**Wireless Networks**	Wireless network, Wireless network Architecture, Classification of wireless networks – WBAN, WPAN, WLAN, WMAN, WWAN. IEEE 802.11, IEEE 802.16, Bluetooth – Standards, Architecture and Services	**06**
3	**Cellular wireless Networks**	Principles of cellular networks – cellular network organization, operation of cellular systems, Handoff. Generation of cellular networks – 1G, 2G, 2.5G, 3G and 4G.	**06**
4	**Mobile communication systems**	GSM – Architecture, Air Interface, Multiple Access Scheme, Channel Organization, Call Setup Procedure, Protocol Signaling, Handover, Security, GPRS – Architecture, GPRS signaling, Mobility management, GPRS roaming, network, CDMA2000-Introduction, Layering Structure, Channels,Logical Channels, Forward Link and Reverse link physical channels, W-CDMA – Physical Layers, Channels, UMTS – Network Architecture, Interfaces, Network Evolution, Release 5, FDD and TDD, Time Slots, Protocol Architecture, Bearer Model Introduction to LTE	**12**
5	**Mobile Network Layer**	Mobile IP – Dynamic Host Configuration Protocol, Mobile Ad Hoc Routing Protocols– Multicast routing	**06**
6	**Mobile Transport Layer**	TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP , TCP over 2.5 / 3G wireless Networks	**07**
7	**Application Layer**	WAP Model- Mobile Location based services -WAP Gateway – WAP protocols – WAP user agent profile, Caching model-wireless bearers for WAP - WML – WMLScripts – WTA.	**07**

References

1. Mobile Communications, Second Edition, Jochen Schiller, Pearson Education
2. Wireless Communications & Networks, Second Edition, William Stallings, Pearson Education
3. Wireless Communications and Networks, 3G and Beyond, Second Edition, ITI SahaMisra, McGraw Hill Education
4. Wireless Network Evolution 2G to 3G, Vijay K. Garg, Pearson Publications.
5. Wireless and Mobile Network Architectures, Yi Bang Lin, ImrichChlamtac, Wiley India.
6. Wireless and Mobile Networks, Concepts and Protocols, Dr. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, Wiley India

7. Multi-Carrier and Spread Spectrum Systems - From OFDM and MC-CDMA to LTE and WiMAX, Second Edition, K. Fazel, S. Kaiser, wiley publications
8. Wireless and Mobile All-IP Networks, Yi-Bing Lin, Ai-Chun Pang, Wiley Publications

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA502	**Advance Distributed Computing**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA502	**Advance Distributed Computing**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA 502	**Advance Distributed Computing**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Computer Networks, Operating Systems

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO502.1	Introduce advance distributed concepts.
CEO502.2	Emphasize on design techniques and constraints of distributed computing
CEO502.3	Emphasize on analysis of cloud computing, its security and its storage

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

MCA502.1	Distinguish between distributed computing and parallel computing
MCA502.2	Understand concepts of SOA.
MCA502.3	Demonstrate different cloud technologies
MCA502.4	Designing security and storage in cloud technologies.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Distributed Computing Concepts**	Basic concepts of distributed systems, distributed computing models, software concepts, issues in designing distributed systems, client server model **Inter Process Communication** Fundamental concepts related to inter process communication including messagepassing mechanism, a case study on IPC in MACH, concepts of group communication and case study of group communication CBCAST in ISIS, API for Internet Protocol. **Remote Communication** Remote Procedural Call (RPC), Remote Method Invocation (RMI),a case study on Sun RPC, a case study on JAVA RMI.	**11**
2	**Clock synchronization**	Introduction ofclock synchronization, global state mutual Exclusion algorithms, election algorithms.	**02**
3	**Distributed Shared Memory**	Fundamental concepts of DSM, types of DSM, various hardware DSM systems, Consistency models, issues in designing and implementing DSM systems.	**06**
4	**Distributed System Management and Object based System**	Resource management, process management, fault tolerance, code migration, CORBA: Overview of CORBA, Communication, Processes, Naming, and Synchronization.	**09**
5	**Introduction to Parallel Computing**	Parallel computing, scope of parallel computing, Abstract model of serial & parallel computation, pipelining, data parallelism, control parallelism, scalability, topologies in processor organization, parallel computing design consideration, parallel algorithms & parallel architectures, applications of parallel computing.	**08**
6	**Advances in Distributed Computing**	Service-Oriented Architecture, Elements of Service-Oriented Architectures, RPC versus Document Orientation, Major Benefits of Service- Oriented Computing, Composing Services, Goals of Composition, Challenges for Composition, Spirit of the Approach.	**04**
7	**Fundamentals of Cloud computing, cloud Security and Storage**	Evolution of Cloud Computing ,cluster computing Grid computing, Grid computing versus Cloud Computing, Key Characteristics of cloud computing. **Cloud models:** Benefits of Cloud models, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Shared Private Cloud, Dedicated Private Cloud, Dynamic Private Cloud, Savings and cost impact, Web services delivered from cloud, Platform as a service, Software as a service,Infrastructure as a service. **Cloud Security Fundamentals and Storage** Privacy and security in cloud, Security architecture, Data security, Identity and access management, security challenges, Storage basics, Storage as a service providers, aspects of data security.	**12**

References:

1. Distributed OS by Pradeep K. Sinha , PHI
2. Distributed Computing by Dr. SunitaMahajan , Seema Shah, Oxford University Press
3. Distributed Operating Systems by Tanenbaum S, Pearson Education
4. Introduction to Parallel Computing (2nd Edition) AnanthGrama ,George Karypis, Vipin Kumar , Anshul Gupta.
5. Parallel and Distributed systems (2nd Edition)Arun Kulkarni, Nupur Prasad Giri,Nikhilesh Joshi, BhushanJadhav, Wiley publication
6. Cloud Computing Unleashing Next Gen Infrastructure to Application(3rd Edition)By Dr. Kumar Saurabh, wiley Publication

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCA503	**User Experience Design**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCA503	**User Experience Design**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA 503	**User Experience Design**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
System Analysis & Design,Software Engineering and Project Management,UML.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO503.1	Develop interest in User Experience Engineering (UXE) Process
CEO503.2	Understand how to design Effective and Efficient User Interfaces for intended users
CEO503.3	Learn tools and techniques for Prototyping and Evaluating User Experiences

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

MCA503.1	Understand and create interest in User Experience Design(UXD)
MCA503.2	Analyze the framework and methodological approach for user experience design.
MCA503.3	Apply prototyping and problems solving techniques related to user experience design.
MCA503.4	Design real life application with end-to-end understanding of User experience practices.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to UX Design**	What is UX, Ubiquitous interaction, Emerging desire for usability, From usability to user experience, Emotional impact as part of the user experience, User experience needs a business case, Roots of usability.	**06**
2	**The UX Design - life cycle**	Introduction, A UX process lifecycle template, Choosing a process instance for your project, The system complexity space, Meet the user interface team, Scope of UX presence within the team, More about UX lifecycles.	**06**
3	**The UX Design Process – Understand Users**	Introduction, The system concept statement, User work activity gathering, Look for emotional aspects of work practice, Abridged contextual inquiry process, Data-driven vs. model-driven inquiry, History. , Contextual Analysis, Extracting Interaction Design Requirements, Constructing Design-Information Models.	**12**
4	**The UX Design Process**	Information ,Architecture and Interaction Design and Prototyping Introduction, Design paradigms, Design thinking, Design perspectives, User personas, Ideation, Sketching, More about phenomenology, Mental Models and Conceptual Design, Wireframe, Prototyping	**10**
5	**The UX Design Process**	UX Evaluation and Improve UX Goals, Metrics and Targets, UX Evaluation Techniques.- Formative vs summative ,types of formative and informal summative evaluation methods, types of evaluation data, some data collection technics, variations in formative evaluation results, informal summative dada analysis, formative data analysis , feedback to process ,evaluation report	**12**
6	**UX methods for Agile Development**	Introduction, Basics of agile SE method , drawbacks of agile SE method from the UX perspective, A synthesized approach to integrate UX	**06**

References

- The UX Book by Rex Hartson and PardhaPyla, MK Publication
- Smashing UX Design by Jesmond Allen and James Chudley**,** John Wiley & Sons
- A Project Guide to UX Design by Russ Unger and Carolyn Chandler, O'reillyRies, Series Editor
- Agile Experience Design by Lindsay Ratcliffe and Marc McNeill , Pearson
- Universal Principles of Design by William Lidwell, Kritina Holden and Jill Butler, Rosenfeild Media
- Human Computer Interaction by Alan Dix, New riders
- Lean UX: Applying Lean Principles to Improve User Experience by Jeff Gothelf and Josh Seiden, Morgan Kaufmann
- Don't Make Me Think, Revisited by Steve Krug, New riders
- The User Experience Team of One by Leah Buley, Rosenfeild Media
- The Elements of User Experience by Jesse James Garrett, New riders

- Sketching User Experiences: The Workbook by Saul Greenberg, SheelaghCarpendale, Nicolai Marquardt and Bill Buxton, Morgan Kaufmann, workbook edition

Web References:

- http://wireframe.vn/books/

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Electives I:
Department Level
Electives(MCADLE504)

Subject Code	Subject Name	Credits
MCADLE5041	**Big Data Analytics**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCADLE5041	**Big Data Analytics**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
MCADLE5041	**Big Data Analytics**	Test1 (T1)	Test2(T2)	Average of T1 & T2					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Database Management Systems, SQL

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEODLE5041.1	Provide fundamental techniques and principles of Big Data Analytics
CEODLE5041.2	Identify the tools required to manage and analyze Big Data
CEODLE5041.3	Understand the data analytics techniques required to solve complex real world problems

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

MCADLE5041.1	Develop and maintain reliable, scalable systems using Apache HADOOP
MCADLE5041.2	Write Map Reduce based application
MCADLE5041.3	Differentiate between conventional SQL and NoSQL
MCADLE5041.4	Analyze and develop Big Data solutions using HIVE and PIG

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction**	Distributed file system and its issues, Introduction to big data, big data characteristics, types of big data, traditional vs. big data approach, big data applications	**08**
2	**Hadoop**	Why Hadoop? Hadoop architecture, Hadoop components HDFS and YARN, comparison between YARN 1 and YARN 2 architecture, HDFS federation : Name Node, Data Node, Resource Manager, Job Tracker, Task Tracker Hadoop Ecosystem : Scoop, HIVE, PIG, Flume, Zookeeper, HBASE Hadoop installation in pseudo distribution mode, running HDFS commands	**10**
3	**Map Reduce**	Understanding Map Reduce, Map Task, Reduce Task, speculative execution, partioner and combiner in Map Reduce Running sample Map Reduce Program: Word Count. Algorithm using Map Reduce : -matrix vector multiplication, -grouping and aggregation -relational algebra operations	**10**
4	**NoSQL**	What is NoSQL? NoSQL - Case study, data architecture pattern: key value, column family, document store. HBASE overview, HBASE data model, row oriented vs. column oriented storage, HBASE architecture, HBASE shell commands	**08**
5	**HIVE**	HIVE : background, architecture, warehouse directory and meta-store, HIVE query language, loading data into table, HIVE built-in functions, joins in HIVE, HIVE installation, HiveQL: querying data, sorting and aggregation	**08**
6	**PIG**	PIG : background, architecture, PIG Latin Basics, PIG execution modes, PIG processing – loading and transforming data, PIG built-in functions, filtering, grouping, sorting data Installation of PIG and PIG Latin commands	**08**

Reference:

- Tom White, “HADOOP: The definitive Guide”, O Reilly 2012
- Chris Eaton, Dirk deroos et al., “Understanding Big Data”, McGraw Hill, 2012.
- Big Data Analytics – RadhaShankarmani and M. Vijayalakshmi Wiley Texbook Series
- Hadoop in Action - Chuck Lam Dreamtech Press
- Hadoop in Practice - Alex Holmes Dreamtech Press

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCADLE5042	**Machine Learning**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCADLE5042	**Machine Learning**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2					
MCADLE5042	**Machine Learning**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Understanding of basic computer science concepts, data structures and good understanding of Mathematical Concepts is required.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEODLE5042. 1	Understand Machine Learning and its techniques.
CEODLE5042. 2	Study regression, classification with AdaBoost and clustering methods.
CEODLE5042. 3	Understand support vector machine, Dimensionality reduction, Anomaly Detection, Recommender Systems

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

MCADLE5042.1	Analyze the Machine Learning techniques.
MCADLE5042.2	Apply regression, classification with AdaBoost and clustering methods to real world applications.
MCADLE5042.3	Describe support vector machine, Dimensionality reduction, Anomaly Detection, Recommender Systems

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Understand Machine Learning**	Introduction to Machine Learning, Overview of Machine Learning, Key Terminology and task of ML, Applications of ML, Software Tools, Introduction to Big Data and Machine Learning, Hypothesis space, Estimate hypothesis accuracy, Hypothesis testing	**06**
2	**Supervised Learning- Classification**	Introduction to Supervised Learning: Classification, Decision Tree Representation- Appropriate problem for Decision Learning, Decision Tree Algorithm, Hyperspace Search in Decision Tree Naive Bayes- Bayes Theorem , Classifying with Bayes Decision Theory , Conditional Probability, Bayesian Belief Network	**08**
3	**Supervised Learning- Regression**	Regression: Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Regression Tree- Using CART for regression Logistic Regression - Classification with Logistic Regression and the Sigmoid Function	**08**
4	**Support Vector Machine**	Introduction : Separating data with maximum margin, Finding the maximum margin, Effective optimization with SMO algorithm	**08**
5	**Improving classification with the AdaBoost**	Classifier using multiple samples of the data set, Improving classifier by focusing on error, weak learner with a decision stump, Implementing the AdaBoost algorithm, Classifying with AdaBoost	**08**
6	**Unsupervised Learning**	Clustering: Learning from unclassified data –Introduction to clustering, K- Mean Clustering, Expectation-Maximization Algorithm(EM algorithm),Hierarchical Clustering, Supervised Learning after clustering	**08**
7	**Additional Core Techniques**	Dimensionality reduction- Dimensionality reduction techniques, Principal component analysis, Anomaly Detection, Recommender Systems	**06**

Reference:

- Machine Learning in Action By Peter Harrington By Manning
- Machine Learning, T. Mitchell, McGraw-Hill, 1997.
- Introduction to Machine LearningBy EthemAlpaydin,MIT Press
- Understanding Machine Learning From Theory to Algorithms By ShaiShalev-Shwartz and Shai Ben David, Cambridge University Press
- Data Mining Concepts and Techniques, J. Han and Kamber

Web References:

- http://www.infoworld.com/article/2853707/robotics/11-open-source-tools-machine-learning.html#slide12
- http://www.ibm.com/developerworks/library/os-recommender1/

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCADLE5043	**Internet of Things**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCADLE5043	**Internet of Things**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2					
MCADLE5043	**Internet of Things**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:
Computer Networks

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEODLE5043. 1	Understand the concepts of IOT
CEODLE5043. 2	Study IoT Architecture
CEODLE5043.3	Understanding the technologies used to build IoT applications.

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

MCADLE5043.1	Identify the use of IoT from a global context.
MCADLE5043.2	Design application using IoT.
MCADLE5043.3	Analyze the IoT enabling Technologies
MCADLE5043.4	Determine the real world problems and challenges in IoT .

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**M2M to IoT**	**M2M to IoT** – The Vision, Introduction: **M2M** ,IoT, From M2M to IoT,M2M towards IoT – the global context, Differing characteristics, M2M value chains, IoT value chains,An emerging industrial structure for IoT, The international-driven global value chain and global information monopolies ,M2M to IoT – An Architectural Overview-,Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations	**10**
2	**IoT Architecture**	**IoT Architecture** – State of the Art Introduction,State of the art, Architecture Reference Model, Introduction, Reference model and architecture, IoT reference model, IoT Reference Architecture, Introduction, Functional view, Information view, Deployment and operational view, Other relevant architectural views	**08**
3	**IoT Enabling Technologies**	**IoT Enabling Technologies** -- Wireless Sensor Networks , Cloud Computing ,Big Data Analytics, Communication Protocols,Embedded Systems	**08**
4	**Real-World Design Constraints**	**Real-World Design Constraints**-Introduction,Technical design constraints – hardware , Data representation and visualization,Interaction and remote control	**04**
5	**Open – Source Prototyping Platforms for IoT**	**Open – Source Prototyping Platforms for IoT**- Basic Arduino Programming Extended Arduino Libraries,Arduino – Based Internet Communication, Raspberry PI,Sensors and Interfacing	**08**
6	**Data Management**	**Data Management**, Business Process in IoT, IoT Analytics, Creative Thinking Techniques, Modification,Combination Scenarios, Decentralized and Interoperable ,Approaches, Object – Information Distribution,Architecture, Object Naming Service (ONS), Service Oriented Architecture, Network of Information, Etc.	**08**
7	**Domain specific**	**Domain specificHome Automation** - Smart Lighting ,Smart Appliances , Intrusion Detection , Smoke/Gas Detectors **Energy**-Smart Grids ,Renewable Energy Systems ,Prognostics **Health & Lifestyle** -Health & Fitness Monitoring ,Wearable Electronics **Agriculture** - Smart Irrigation ,Green House Control **Retail**- Inventory Management , Smart Payments ,Smart Vending Machines **Cities** -Smart Parking ,Smart Lighting ,Smart Roads ,Structural Health Monitoring ,Surveillance ,Emergency Response	**06**

References:

- From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, Jan Holler VlasiosTsiatsis Catherine Mulligan Stefan Avesand StamatisKarnouskosDavid Boyle
- VijayMadisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014
- Getting Started with the Internet of Things by CunoPfister
- The Internet of Things: Connecting Objects by HakimaChaouchi
- FrancisdaCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

Assessment:

Internal:
Assessment consists of two tests (T1 and T2).The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCADLE5044	**Multimedia System Design**	**04**

Subject Code	Subject Name :	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCADLE5044	**Multimedia System Design**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
MCADLE5044	**Multimedia System Design**	Test1 (T1)	Test2(T2)	Average of T1 & T2					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Prerequisite:
Computer Graphics

Course Educational Objectives (CEO): At the end of the course students will be able to

CEODLE 5044.1	Study various multimedia system design components.
CEODLE 5044.2	Understand compression and decompression techniques and different image formats.
CEODLE 5044.3	Interpret storage and retrieval technologies, Project planning and costing.

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

MCADLE 5044.1	Perceive multimedia architecture and its latest applications.
MCADLE 5044.2	Implement compression, decompression techniques and different formats for image, audio and video.
MCADLE 5044.3	Plan and develop multimedia projects

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Fundamentals of Multimedia Systems Design**	An Introduction Multimedia Systems, Design Fundamentals, Elements of multimedia, Multimedia system architecture - High resolution graphics display, IMA Architectural Framework, Network architecture for multimedia systems , Defining objects for Multimedia systems: Text, Images, Audio and video	**07**
2	**Multimedia Input and Output Technologies**	Key Technology Issues, Touch screen, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video.	**11**
3	**Multimedia File format and standards**	RTF, TIFF,RIFF, MIDI, JPEG DIB, AVI, MIDI audio, JPEG & MPEG standards, MIDI Vs Digital Audio, Analog display standards ,Digital display standards, Digital video	**10**
4	**Compression and Decompression Techniques**	Introduction to coding and compression techniques- Lossy and Lossless , Entropy encoding, Run length encoding, Huffman coding, JPEG compression process, Discrete Cosine Transform, Video compression- MPEG-1, MPEG-2, MPEG-4, Audio Compression-MPEG, Adaptive differential pulse code modulation,	**12**
5	**Storage and retrieval technologies**	Magnetic Media Technology, RAID-Level-0 To 5, Optical Media, WORM optical drives	**06**
6	**Planning and costing**	Idea Analysis, Pretesting, Task Planning, Prototype Development, Alpha Development, Beta Development, Delivery, Scheduling, Estimating	**06**

References:

- Multimedia Systems Design Paperback –PrabhatK.Andleigh, KiranThakrar , Pearson Education India, 2015
- Multimedia: Making it Work, Seventh Edition, TayVaguhan, McGraw Hill Professional, 2008
- Fundamentals of Multimedia 2005 by Li and Ze – Nian ,Mark s Drew, PHI
- Multimedia Systems, John F. Koegel Buford, Pearson Education

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Electives II:
Institute Level Electives
(MCAILE505)

Subject Code	Subject Name	Credits
MCAILE5051	**Intellectual Property Rights and Patents**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAILE 5051	**Intellectual Property Rights and Patents**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA ILE5051	**Intellectual Property Rights and Patents**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic understanding of morals/ethics, social values and technical writing.

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOILE5051.1	Understand basics of intellectual property.
CEOILE5051.2	Relate the knowledge of Intellectual Property Laws of India as well as International treaty procedures.
CEOILE5051.3	Get acquaintance with Patent search and patent filing procedure and applications.

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

MCAILE5051.1	Understand Intellectual Property assets.
MCAILE5051.2	Assist individuals and organizations in capacity building.
MCAILE5051.3	Distinguish information across organizations.
MCAILE5051.4	Work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to IPR**	**Introduction:** Concepts and meaning of Intellectual property, IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Semiconductor Integrated Circuits Layout-Design, Plant variety protection, Geographical indications, Transfer of technology etc. **Indian Scenario of IPR**: Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India.	**10**
2	**Ownership and Enforcement of IPR**	**Enforcement of Intellectual Property Rights:** Introduction, Extent of problem, Factors that create and sustain counterfeiting/piracy, International Organizations, Agencies, and treaties active in IPR enforcement (e.g. INTA,WIPO,WTO, Madrid Protocol, Paris convention, NAFTA,TRIPS). **Ownership of intellectual property rights:** Ownership, Changes of Ownership	**08**
3	**Emerging Issues and Management of IPR**	**Emerging Issues of IPR:** IPRrelationship with software and technology, Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc. **Management of IPR:** Introduction, Overall management of IPRs ,Management of non-registrable rights	**06**
4	**Copyrights**	Introduction and law, Types of copyright, Ownership and duration of copyright, Marking, Moral rights, Other relevant law, Copyright use and misuse, Exceptions to copyright infringement – fair dealing, Taking action against infringers, Criminal liability, Copyright licenses, Copyright internationally – general and non-technical works, Technical copyright, Copyleft, Managing copyright	**08**
5	**Trademarks**	Introduction to trade marks, Registrable trademarks, Unregistered trademarks, 'get-up' and 'passing-off', Criminal provisions and counterfeiting, Avoid being sued, Trade marks in other countries, Domain names	**07**
6	**Patents**	Introduction, Process to get a patent, Filing a patent application, Patent applications in India and other countries, Search Patents on Indian Patent Office Website	**08**
7	**Confidential information**	Introduction, Confidential disclosure, Employees, Confidential computer programs, Unwanted confidences, Managing confidential information, Know-how and show-how, Legal remedies, Confidentiality in other countries, Summary of confidentiality	**05**

References:

- Vivien Irish, Second Edition, Intellectual Property Rights for Engineers, IET
- Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
- Deborah E. Bouchoux, Fourth Edition, Intellectual Property The Law of Trademarks, Copyrights, Patents, and Trade Secrets, CENGAGE Learning.
- Wipo intellectual property handbook
- Hyde W. Cornish, First Edition, Intellectual Property Right, Global Vision Publishing House
- P. Narayanan, Third Edition, Intellectual, Property Law, Eastern Law House.

Web References:

- http://www.ipindia.nic.in/
- http://ipindiaservices.gov.in/publicsearch/
- http://www.ipindia.nic.in/writereaddata/Portal/IPOAct/1_32_1_patent_act_1977-3-99.pdf
- http://www.icai.org

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAILE5052	**Research Methodology**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAILE 5052	**Research Methodology**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA ILE5052	**Research Methodology**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic knowledge of Mathematics for Data Analysis, Software, Internet

Course Educational Objectives (CEO): At the end of the course, the students will be able to:

CEO ILE5052.1	To understand Research and Research Process
CEO ILE5052.2	To acquaint students with identifying problems for research and develop research strategies
CEO ILE5052.3	To familiarize students with the techniques of data collection, analysis of data and interpretation

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

MCAILE5052.1	Prepare a preliminary research design for projects in their subject matter areas
MCAILE5052.2	Accurately collect, analyze and report data
MCAILE5052.3	Present complex data or situations clearly
MCAILE5052.4	Review and analyze research findings Get the knowledge of objectives and types of research

Syllabus

Sr. No	Module	Detailed Contents	Hrs
1	**Introduction and Basic Research Concepts**	Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research , Issues and Problems in Research , Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	**10**
2	**Types of Research**	Basic Research , Applied Research , Descriptive Research,Analytical Research , Empirical Research ,Qualitative and Quantitative Approaches	**08**
3	**Research Design and Sample Design**	Research Design – Meaning, Types and Significance , Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	**10**
4	**Research Methodology**	Meaning of Research Methodology ,Stages in Scientific Research Process: Identification and Selection of Research Problem , Formulation of Research Problem , Review of Literature , Formulation of Hypothesis , Formulation of research Design , Sample Design , Data Collection , Data Analysis , Hypothesis testing and Interpretation of Data , Preparation of Research Report	**08**
5	**Formulating Research Problem**	Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**08**
6	**Outcome of Research**	Preparation of the report on conclusion reached , Validity Testing & Ethical Issues , Suggestions and Recommendation	**08**

References:

- Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
- Kothari, C.R.1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
- Kumar Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.

- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any four from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAILE5053	**Management Information System**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAILE 5053	**Management Information System**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
MCA ILE5053	**Management Information System**	Test1 (T1)	Test2 (T2)	Average of T1 & T2					
		20	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Information Technology in Management

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOILE5053.1	Understand the nature of management information systems and their applications in business
CEOILE5053.2	Learn the core activities in the systems development process.
CEOILE5053.3	Identify the major management challenges in building and using information systems.

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

MCAILE5053.1	Understand theoretical aspects of Management Information Systems
MCAILE5053.2	Know the procedures and practices for performing information system planning and design.
MCAILE5053.3	Gain knowledge in various Decision Support Systems
MCAILE5053.4	Understand the implications of Management Information Systems on business

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Management Information Systems**	Perspectives on Information Systems, Nature and scope of MIS, Characteristics of MIS, Need and Role of MIS, Impact of MIS, functions and future of MIS, MIS: A support to the management, MIS: organization effectiveness, MIS for a digital firm, Case Study	**09**
2	**Strategic Design and Development of MIS**	Strategic Management of the Business, Strategic design of MIS,Business Strategy Implementation, Development of Long Range Plans of MIS, Ascertaining the class of Information, Determining the Information Requirement, Development and Implementation of MIS, MIS: Development Process Model, case study.	**10**
3	**Decision Making**	Decision making concepts, Decision Analysis by analytical modelling, Behavioral concepts in decision making, Organizational decision making, MIS and Decision Making, Case Study	**09**
4	**Information, knowledge, Business Intelligence**	Information Concepts, Information :A Quality Product, Classification of the information, Methods of data and information collection, Value of information, General model of a human as a information processor, Summary of information concepts and their implications, Knowledge and knowledge management systems, Business Intelligence, MIS , and the Information and Knowledge, Case Study	**10**
5	**E-Commerce: Applications and Issues**	Introduction to E-Commerce**,** Scope of E-commerce, E-Commerce Applications and Issues, case study	**07**
6	**Securing Information Systems**	System Vulnerability and Abuse, Business value of security and control, Technology and Tools for protecting Information, Resources,case study	**07**

References:

- Management Information Systems- A digital form perspective, 4th edition - By W.S.Jawdekar, TMG Publications
- Management Information Systems- A global digital Enterprise perspective, 5th edition - By W.S.Jawdekar, TMG Publications
- Management Information System, James O'Brien, 7th edition, TMH
- Management Information Systems, Loudon and Loudon, 11th edition, Pearson.

Assessment:

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAILE5054	**Green Computing**	**04**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
MCAILE 5054	**Green Computing**	**04**	**--**	**--**	**04**	**--**	**--**	**04**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCA ILE5054	**Green Computing**	**20**	**20**	**20**	**80**	**--**	**--**	**--**	**100**

Pre-requisites:

Basic knowledge of Hardware, software and networking

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOILE5054.1	Understand what Green IT is and how we can meet standards set for Green Computing
CEOILE5054.2	Comprehend Green IT from the perspective of hardware, software, storage, and networkingat the enterprise level.
CEOILE5054.3	Strategize Green Initiatives and look at the future of Green IT

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

MCAILE5054.1	Create awareness among stakeholders and promote green initiatives in their environments leading to a green movement.
MCAILE5054.2	Adopt special skills such as knowledge about energy efficiency, ethical IT assets disposal, carbon footprint estimation.
MCAILE5054.3	Create eco-friendly environment.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs

1	**Trends and Reasons to Go Green**	• Overview and Issues
		• Current Initiatives and Standards
		• Consumption Issues
		  o Minimizing Power Usage
		  o Cooling
			08

2	**Introduction to Green IT**	• Green IT
		• Holistic Approach to Greening IT
		• Awareness to Implementation
		  o Green IT Trends
		  o Green Engineering
		• Greening by IT
		  o Using RFID for Environmental Sustainability
		  o Smart Grids
		  o Smart Buildings and Homes
		  o Green Supply Chain and Logistics
		  o Enterprise-Wide Environmental Sustainability
			08

3	**Green Hardware and Software**	**Green Hardware** • Introduction , • Life Cycle of a Device or Hardware , • Reuse, Recycle and Dispose **Green Software** • Introduction • Energy-Saving Software Techniques **Changing the way we work** • Going Paperless	**08**
4	**Green Data Centers and Storage**	**Green Data Centers** • Data Centre IT Infrastructure • Data Centre Facility Infrastructure: Implications for Energy Efficiency • IT Infrastructure Management • Green Data Centre Metrics **Green Data Storage** • Introduction • Storage Media Power Characteristics • Energy Management Techniques for Hard Disks • System-Level Energy Management **Green Networks and Communications** • Introduction • Objectives of Green Network Protocols • Green Network Protocols and Standards	**08**
5	**Enterprise Green IT Strategy**	• Introduction • Approaching Green IT Strategies	**08**

		• Business Drivers of Green IT Strategy • Business Dimensions for Green IT Transformation • Organizational Considerations in a Green IT Strategy • Steps in Developing a Green IT Strategy • Metrics and Measurements in Green Strategies • Organizational and Enterprise Greening • Greening the Enterprise: IT Usage and Hardware	
6	**Managing and Regulating Green IT**	**Managing Green IT** • Introduction • Strategizing Green Initiatives • Implementation of Green IT • Information Assurance • Communication and Social Media **Regulating Green IT** • Introduction • The Regulatory Environment and IT Manufacturers • Non-regulatory Government Initiatives • Industry Associations and Standards Bodies • Green Building Standards • Green Data Centres • Social Movements and Greenpeace **The Future of Green IT** • Green Computing and the Future • Megatrends for Green Computing • Tele-presence Instead of Travel • Tele-commuting Instead of Commuting • Deep Green Approach	**12**

References:

- Toby Velte, Anthony Velte, Robert Elsenpeter, 2008, Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line, McGraw Hill.
- San Murugesan, G. R. Gangadharan, 2013, Harnessing Green IT, WILEY.
- Bud E. Smith, 2014, Green Computing-Tools and Techniques for saving energy, money and resources, CRC Press.
- Mark G. O'Neill, GREEN IT FOR SUSTAINABLE BUSINESS PRACTICE, An ISEB Foundation Guide.
- Jason Harris, Green Computing and Green IT Best Practices.

Web References:

- http://www.carbonfootprint.com
- https://www.energystar.gov/

Assessment:

Internal:

Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAL501	**Mobile Application and User Experience Design Lab**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut.	Total
MCAL501	**Mobile Application and User Experience Design Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
MCAL501	**Mobile Application and User Experience Design Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:

Basic understanding on Java programming and XML

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOL501.1	Understand the entire Android Apps Development Cycle
CEOL501.2	Apply the advanced android development techniques
CEOL501.3	Conceptualize the design of user applications using User Experience Design.

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

MCAL501.1	Demonstrate Android activities life cycle
MCAL501.2	Apply proficiency in coding on a mobile programming platform.
MCAL501.3	Design and develop innovative android applications
MCAL501.4	Create real life application with end-to-end understanding of User experience practices.

Syllabus

Sr. No.	Module	Detailed Contents	Hrs
1	**Introduction to Android**	The android platform, the layers of android, Four kinds of android components, understanding the androidManifest.xml file, creating an android application Introduction to android SDK, Exploring the development environment	**04**
2	**User interfaces**	Creating the activity, working with views, using resources Working with intents and services, Different types of layouts, components.	**06**
3	**Storing and Retrieving data**	Using the file system, working with shared preferences, persisting data to a database, Working with content providers	**10**
4	**Graphics and animation, Multimedia**	Drawing graphics in android, creating animations with androids graphics API,Playing audio & video, Capturing media	**06**
5	**Location, Sensors**	Using Location Manager and Location Provider, working with maps, Working with GPS, Bluetooth and WiFi, Integrating google maps, services for push notificationGoogleads.	**04**
6	**REST API integration**	UsingAsyncTask to perform network operations, introduction to HtttpUrlConnection and JSON, performing network operations asynchronously, working with OkHttp, Retrofit and Volley	**08**
7	**Database connectivity and distributing androidapplication**	SQLite Programming, Android database connectivity using SQLite , distribution options, packaging and testing the application, distributing applications on google play store	**08**
8	**Open source UX tools**	Study of open source UX tools	**02**
9	**Creating new prototype**	selecting device, defining prototype settings	**02**
10	**Identify and describe the objectives for UED experiment**	a. Perform user research b. User requirement collection c. User Requirement Analysis d. Create User personas, user scenarios , customer journey maps	**08**
11	**UX Design – for Web and Mobile application**	a. Conceptual Design- Site Maps b. Create Wireframe c. Create Screens, Widgets, Outlines d. Setting properties e. Ordering Screens, Screen Transition f. Adding Actions & Triggers, Header & footer	**08**
12	**UX Evaluation**	a. Set UX Goals b. Perform UX Evaluation and Reporting c. Usability Test	**02**
13	**Mini project**	Developing mobile applications based on UED principles.	**10**

References

- Android in action, Third Edition, W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz, Dreamtech Press.
- Beginning Android 4 Application Development, Wei-Meng Lee, Wrox Publications
- Helllo, Android Introducing Google's Mobile Development Platform, Fourth Edition, Ed Burnette, SPD Publications.
- The UX Book by Rex Hartson and PardhaPyla, MK Publication
- Smashing UX Design by Jesmond Allen and James Chudley, John Wiley & Sons
- A Project Guide to UX Design by Russ Unger and Carolyn Chandler, O'reillyRies, Series Editor
- Agile Experience Design by Lindsay Ratcliffe and Marc McNeill , Pearson
- Universal Principles of Design by William Lidwell, Kritina Holden and Jill Butler, Rosenfeild Media
- Human Computer Interaction by Alan Dix, New riders
- Lean UX: Applying Lean Principles to Improve User Experience by Jeff Gothelf and Josh Seiden, Morgan Kaufmann
- Don't Make Me Think, Revisited by Steve Krug, New riders
- The User Experience Team of One by Leah Buley, Rosenfeild Media
- The Elements of User Experience by Jesse James Garrett, New riders
- Sketching User Experiences: The Workbook by Saul Greenberg, SheelaghCarpendale, Nicolai Marquardt and Bill Buxton, Morgan Kaufmann, workbook edition

Assessment:
Term work consists of any two case studies or mini project covering the above syllabus.

Internal:
Assessment consists of two tests (T1 and T2) .The final marks should be the average of the two tests.

End Semester Theory Examination: Guidelines for setting up the question paper.

- Question paper will comprise of total six questions.
- Question Number One should be compulsory.
- All question carry equal marks.
- Students can attempt any three from the remaining.
- Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3).

In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Subject Code	Subject Name	Credits
MCAL502	**Open Source System for ADC Lab**	**03**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut.	Total
MCAL502	**Open Source System for ADC Lab**	**--**	**06**	**--**	**--**	**03**	**--**	**03**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1(T1)	Test2(T2)	Average of T1 & T2					
MCAL502	**Open Source System for ADC Lab**	**--**	**--**	**--**	**--**	**25**	**50**	**25**	**100**

Pre-requisites:

Basic overview of Advanced Distributed Computing and Cloud Computing.

Course Educational Objectives (CEO): At the end of the course student will be able to

CEOL502.1	To Understand Concepts of distributed and cloud computing
CEOL502.2	To learn open source technology.
CEOL502.3	To teach various protection and security mechanisms for data using cloud concepts

Course Outcomes (CO): At the end of the course student will be able to

MCAL502.1	Design and Develop the solution to a problem using java concepts
MCAL502.2	Demonstrate use of java Concepts
MCAL502.3	Explore various advanced distributed concepts.

Syllabus

Sr. No.	Session	Detailed Contents	Hrs
1	**Remote Process Communication**	**Develop a program for multi-client chat server. Concept:** Develop a multi-client chat server application where multiple clients chat with each other concurrently. The messages sent by different clients are first communicated to the server and then the server, on behalf of the source client, communicates the messages to the appropriate destination client.	**08**
2	**Remote Procedure call**	**Implementation of Remote Procedure Call Concept:** This application will demonstrate the remote procedure communication. a) Implement a Server calculator containing ADD(),MUL(),SUB() etc. b) Implement a Date Time Server containing date() and time()	**08**
3	**Remote Method Invocation**	**Remote Method Invocation supporting the distributed computing in java.** **Concept:** Create a client and server application where the client invokes methods via an interface. These methods are implemented on the server side. Create the necessary STUBS and SKELETONS. a) Design a Graphical User Interface (GUI) based calculator (scientific or standard). Operations should be performed using both mouse and keyboard. b) Retrieve time and date function from server to client. This program should display server date and time. c) Equation solver. The client should provide an equation to the server through an interface. The server will solve the expression given by the client. (a-b)2 = a2 –2ab + b2; If a = 5 and b = 2 then return value = 52 – 2.5.2 + 22 = 9.	**14**
4	**Memory Management**	**Implementation of Shared Memory** a) Write a program to increment counter in Shared memory	**04**
5	**Remote Object Communication**	**Remote objects for database access.** **Concept:**Pass remote objects from the server to the client. The client will receive the stub object (through remote interfaces) and saves it in an object variable with the same type as the remote interface. Then the client can access the actual object on the server through the variable. Make use of JDBC and RMI for accessing multiple data access objects. a) Retrieve the students information from the college database. b) Retrieve the list of books available in the library. c) Retrieve the MTNL billing information from the MTNL database	**10**
6	**Enterprise Java Beans**	1) Sample program for basic arithmetic operations implemented in session bean. 2) Sample program on message bean demonstration.	**10**

		3)Sample program to Book Information using Entity bean 4) Demonstrate a program on Statefull and Stateless Bean.	
7	**Mutual Exclusion**	**Implementation of mutual exclusion using any of the technique.** **Concept**: This technique solves the mutual exclusion existing in the process communication. a) Centralized b) Distributed c) Token Ring **Note:** Use any one technique	**08**
8	**Cloud Computing**	**Study of cloud technologies :** Virtualization Technologies, Virtual Machine Technology, Cloud data center	**08**
9	**Grid Services**	**Study of Grid services using various tools.(any two)**	**02**
10	**Case studies**	Google, Microsoft, AWS.	**06**

Based on the recommended syllabus student should provide one Presentation/Case study.

Reference Books:-

1. Core Java2 Volume I & II – Horstmann, Cornell.
2. Complete Reference – Herbert Schildt.
3. Distributed computing system and concepts – Andrew Tanenbaum
4. Distributed OS - Pradeep K. Sinha , PHI
5. Cloud Computing unleashing next gen infrastructure to application – Dr.KumarSaurabh,willey
6. Cloud Computing insights into new-era infrastructure –Dr.Kumarsaurabh, willey

Subject Code	Subject Name	Credits
MCAPR501	**Mini Project**	**02**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut.	Total
MCAPR501	**Mini Project****	**--**	**--**	**--**	**--**	**--**	**--**	**02**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA PR501	**Mini Project**	--	--	--	--	**25**	**--**	**25**	**50**

Pre-requisites:

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOPR501.1	Conceptualize knowledge with emphasis on team work, effective communication, critical thinking and problem solving skills.
CEOPR501.2	Adapt to a rapidly changing environment by having learned and applied new skills and new technologies.
CEOPR501.3	Study designing small projects in a multidisciplinary environment.

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

MCAPR501.1	Design, implement and evaluate a project.
MCAPR501.2	Gain project management skills.
MCAPR501.3	Work effectively and ethically in a team towards project development
MCAPR501.4	Demonstrate the ability to produce a technical document.

Sample Guidelines for Preparing and Documenting the Project Report

Sr. No.	Module	Detailed Contents
1	Introduction	• Introduction of the project • Problem definition • Objective of Project • scope of Project
2	Literature Survey	• Existing System • Proposed System • Knowledge Integration • Use Cases
3	Analysis	• Exploring Possibilities • Feasibility Analysis • Cost Benefit Analysis • Flowchart/ DFD/ER/UML diagram(any other project diagram
4	Methodology	• Criteria & constraints (Process models) • Tools used • Procedure
5	Design And Developing A Prototype	• Module design and organization • Data Design • user interface design • Model or Prototype
6	Project Execution Plan	Plan using Project Management Tools
7	Testing & Validation	Test cases and Report (based on manual & automation testing)
8	User Manual	• Explanation of Key functions • Method of Implementation • Forms • Output Screens
9	Conclusion	Project Conclusion & Future enhancement

- Rubrics guidelines to be followed during project evaluation.
- **REFERENCES should be written as**
  1. Author Name, Title of Paper/ Book, Publisher's Name, Year of publication
  2. Full URL Address

Parameters for Evaluation:

- The mini project is evaluated for 50 marks.
- Term work should be based on 2 presentations of ten marks each and five marks for documentation.
- Oral (25 marks) should be based on final demonstration and presentation.

** Mini Project will be performed by students during summer vacation of Even Semester of second year (SEM IV). Mini project will be evaluated in SEM V. Evaluation of the mini project will be internal 25 marks as TW and 25 marks as oral examination conducted by External Examiner.

Program Structure for

Master of Computer Application (CBCGS)
Mumbai University
(With Effect from 2017-2018)
Semester VI

Subject Code	Subject Name	Teaching Scheme (Contact Hours)	Credits Assigned	
		Presentation	Project	Total
MCAPR601	Internship – Project	30	15	15
MCA 602	Seminar – Research Paper	05	01	01
Total		**35**	**16**	**16**

Subject Code	Subject Nam	Examination Scheme				
		Theory Course				Total
		Internal Assessment			End Sem. Exam.	
		Presentation 1	Presentation 2	Total		
MCA PR601	Internship – Project	25	25	50	100	150
MCA 602	Seminar – Research Paper	--	--	--	50	50
Total		**25**	**25**	**50**	**150**	**200**

SEMESTER VI

Subject Code	Subject Name	Credits
MCAPR 601	**Internship- Project**	**15**

Subject Code	Subject Name	Teaching Scheme	Credits Assigned	
		Presentation	Project	Total
MCA PR601	**Internship- Project**	**30**	**15**	**15**

Subject Code	Subject Name	Examination Scheme				
		Theory Course				Total
		Internal Assessment			End Semester Exam	
		Presentation 1	Presentation 2	Total		
MCAP R601	**Internship- Project**	**25**	**25**	**50**	**100**	**150**

Pre-requisites: --

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEOPR601.1	Achieve hands on experience in an organization
CEOPR601.2	Relate classroom and textbook learning to the real world.
CEOPR601.3	Learn the professional skills and interpersonal relationship in professional environment

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

MCAPR601.1	Attain an exposure to real life organizational and environmental situations
MCAPR601.2	Attain technical skills as per the requirements of the domain
MCAPR601.3	Adapt professional and interpersonal ethics.
MCAPR601.4	Articulate SDLC phases in developing software project and in writing the project document.

The guidelines regarding preparation of Internship-Project report for MCA SEM-VI

- To take hands-on experience of the real world, every candidate is required to undertake a project of 6 months duration in an organization of repute and must submit their project documentation.
- Each student should submit different documentation in a specified format illustrating his/her role/contribution in the project and write the documentation from his/her perspective.
- One copy should be submitted for University records which will be retained by the college and another one is student copy.
- Each student must submit one CD having the documentation part in PDF file format only.
- Hard copy of the project report must be submitted before a week of finalpresentation.
- Students have to present their project individually.

- Feedback form from the Industry should be submitted separately in sealed envelope to the internal guide.
- Students must ensure the originality of the work with ethics.

Assessment:

Internal:
Assessment consists of two presentations of 25 marks each.The final marks should be the sum of the two presentations.

Rubrics has to be followed during project evaluation.

Subject Code	Subject Name	Credits
MCA602	**Research Paper**	**01**

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Presentation	Pract	Tut	Presentation	Pract	Tut	Total
MCA602	**Research Paper**	**05**	**--**	**--**	**01**	**--**	**--**	**01**

Subject Code	**Subject Name**	Examination Scheme							
		Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2					
MCA602	**Research Paper**	--	--	--	**50**	--	--	--	**50**

Course Educational Objectives (CEO): At the end of the course, the students will be able to

CEO602.1	Understand analytic approach towards choosing a research project and acquiring research skills
CEO602.2	Access relevant data and present new ideas related to area of research.
CEO602.3	Adhere to ethical standard of research.

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

MCA602.1	Write a research paper.
MCA602.2	Present data coherently and effectively, outcome and counter-hypothesis
MCA603.3	Attain experience in preparation of research materials for publication or presentation.

Seminar (50 Marks)-

1. Students must have in depth study in a specialized area by doing a survey of published technical literature and write a research paper in IEEE format (6-9 pages).
2. The research topic must be approved from the Institute. The institute should set up a committee to scrutinize the topics and finalize the same
3. The research paper may be written in a group of maximum 2 students.
4. The research paper must be published in national/ international conference or national/ international journal of repute.
5. The bifurcation of marks for the seminar will be as follows:
    a. Original Contribution – 10 marks
    b. Paper Quality – Published (5 marks)
    Contents (5 marks)
    c. Documentation (Language format) – 10 Marks
    d. Oral Presentation – 10 Marks
    e. Conclusion (Future Scope/ Recommendations/ Suggestions/ Findings)-10 marks

Reference:

1. James D. Lester , Writing Research Papers: A Complete Guide (10th Edition)
2. How to Write a Great Research Paper, Book Builders, Beverly Chin, July 2004, Jossey-Bass

Web References:

- https://www.ieee.org/publications_standards/publications/authors/author_guide_interactive.pdf
- http://www.fcsresearch.org/index.php?option=com_content&view=article&id=83&Itemid=166
- https://www.ece.ucsb.edu/~parhami/rsrch_paper_gdlns.htm
- http://nob.cs.ucdavis.edu/classes/ecs015-2007-02/paper/citations.html

Assessment:

Marking Scheme

Sr	Topics	Marks
1	Original Contribution	10
2	Published	5
	Contents	5
3	Documentation	10
4	Oral Presentation	10
5	Future Scope/ Recommendations/ Suggestions/ Findings	10

Rubrics have to be followed during research paper evaluation.