

**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
MCADL E504	Elective 1 (Departmental level)	04	--	--	04	--	--	04
MCAILE 505	Elective 2 (Institutional Level)	04	--	--	04	--	--	04
MCA L501	Mobile Application and User experience Design Lab	--	06	--	--	03	--	03
MCAL50 2	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.					
		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	
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

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							
MCA501	Wireless and Mobile Technology	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		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							
MCA 502	Advance Distributed Computing	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2		End Semester Exam			
		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 of clock 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							
MCA503	User Experience Design	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2					
		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							
MCA DLE5041	Big Data Analytics	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T 2)	Average of T1 & T2		End Semester Exam			
		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, partitioner 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 Textbook 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							
MCADLE5042	Machine Learning	Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2	End Semester Exam	--	--	--	100
		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 Learning By Ethem Alpaydin, MIT Press
- Understanding Machine Learning From Theory to Algorithms By Shai Shalev-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							
MCA DLE5043	Internet of Things	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2		End Semester Exam			
		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 specific Home 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
- VijayMadiseti 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							
MCADLE5044	Multimedia System Design	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2		End Semester Exam			
		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							
MCA ILE5051	Intellectual Property Rights and Patents	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2		80			
		20	20	20	--		--	--	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	<p>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.</p> <p>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.</p>	10
2	Ownership and Enforcement of IPR	<p>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).</p> <p>Ownership of intellectual property rights: Ownership, Changes of Ownership</p>	08
3	Emerging Issues and Management of IPR	<p>Emerging Issues of IPR: IPR relationship with software and technology, Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.</p> <p>Management of IPR: Introduction, Overall management of IPRs, Management of non-registrable rights</p>	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							
MCA ILE5052	Research Methodology	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2		End Semester Exam			
		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	
MCAILE5053	Management Information System	04	--	--	04	--	--	04	
Subject Code	Subject Name	Examination Scheme							
MCAILE5053	Management Information System	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2	End Semester Exam				
		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	
MCAILE5054	Green Computing	04	--	--	04	--	--	04	
Subject Code	Subject Name	Examination Scheme							
MCAILE5054	Green Computing	Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
		20	20	20		80	--	--	--

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 networking at 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	<ul style="list-style-type: none"> • Overview and Issues • Current Initiatives and Standards • Consumption Issues <ul style="list-style-type: none"> ○ Minimizing Power Usage ○ Cooling 	08
2	Introduction to Green IT	<ul style="list-style-type: none"> • Green IT • Holistic Approach to Greening IT • Awareness to Implementation <ul style="list-style-type: none"> ○ Green IT Trends ○ Green Engineering • Greening by IT <ul style="list-style-type: none"> ○ Using RFID for Environmental Sustainability ○ Smart Grids ○ Smart Buildings and Homes ○ Green Supply Chain and Logistics ○ Enterprise-Wide Environmental Sustainability 	08
3	Green Hardware and Software	<p>Green Hardware</p> <ul style="list-style-type: none"> • Introduction , • Life Cycle of a Device or Hardware , • Reuse, Recycle and Dispose <p>Green Software</p> <ul style="list-style-type: none"> • Introduction • Energy-Saving Software Techniques <p>Changing the way we work</p> <ul style="list-style-type: none"> • Going Paperless 	08
4	Green Data Centers and Storage	<p>Green Data Centers</p> <ul style="list-style-type: none"> • Data Centre IT Infrastructure • Data Centre Facility Infrastructure: Implications for Energy Efficiency • IT Infrastructure Management • Green Data Centre Metrics <p>Green Data Storage</p> <ul style="list-style-type: none"> • Introduction • Storage Media Power Characteristics • Energy Management Techniques for Hard Disks • System-Level Energy Management <p>Green Networks and Communications</p> <ul style="list-style-type: none"> • Introduction • Objectives of Green Network Protocols • Green Network Protocols and Standards 	08
5	Enterprise Green IT Strategy	<ul style="list-style-type: none"> • Introduction • Approaching Green IT Strategies 	08

		<ul style="list-style-type: none"> • 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	<p>Managing Green IT</p> <ul style="list-style-type: none"> • Introduction • Strategizing Green Initiatives • Implementation of Green IT • Information Assurance • Communication and Social Media <p>Regulating Green IT</p> <ul style="list-style-type: none"> • 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 <p>The Future of Green IT</p> <ul style="list-style-type: none"> • 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							
MCA L501	Mobile Application and User Experience Design Lab	Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2 (T2)	Average of T1 & T2					
		--	--	--	--	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 HttpURLConnection and JSON, performing network operations asynchronously, working with OkHttp, Retrofit and Volley	08
7	Database connectivity and distributing android application	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
- Hello, 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							
MCA L502	Open Source System for ADC Lab	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1(T1)	Test2(T2)	Average of T1 & T2		--			
		--	--	--	--		25	50	25

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. $(a-b)^2 = a^2 - 2ab + b^2$; If $a = 5$ and $b = 2$ then return value = $5^2 - 2.5.2 + 2^2 = 9$.	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							
MCA PR501	Mini Project	Theory Marks				TW	Pract	Oral	Total
		Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2					
		--	--	--	--	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	<ul style="list-style-type: none"> • Introduction of the project • Problem definition • Objective of Project • scope of Project
2	Literature Survey	<ul style="list-style-type: none"> • Existing System • Proposed System • Knowledge Integration • Use Cases
3	Analysis	<ul style="list-style-type: none"> • Exploring Possibilities • Feasibility Analysis • Cost Benefit Analysis • Flowchart/ DFD/ER/UML diagram(any other project diagram)
4	Methodology	<ul style="list-style-type: none"> • Criteria & constraints (Process models) • Tools used • Procedure
5	Design And Developing A Prototype	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 Name	Examination Scheme					Total
		Theory Course				End Sem. Exam.	
		Internal Assessment			Total		
		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				
MCAP R601	Internship- Project	Theory Course				Total
		Internal Assessment			End Semester Exam	
		Presentation 1	Presentation 2	Total		
		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 final presentation.
- 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
MCA602	Research Paper	Internal Assessment			End Semester Exam				
		Test1 (T1)	Test2(T2)	Average of T1 & T2					
		--	--	--	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)-

- 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).
- The research topic must be approved from the Institute. The institute should set up a committee to scrutinize the topics and finalize the same
- The research paper may be written in a group of maximum 2 students.
- The research paper must be published in national/ international conference or national/ international journal of repute.
- The bifurcation of marks for the seminar will be as follows:
 - Original Contribution – 10 marks
 - Paper Quality – Published (5 marks)
Contents (5 marks)
 - Documentation (Language format) – 10 Marks
 - Oral Presentation – 10 Marks
 - 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.