

**UNIVERSITY OF MUMBAI**



**Revised Syllabus**

**For**

**Master of Computer Applications: MCA**

**Semester I and II**

**Under**

**FACULTY OF TECHNOLOGY**

**(As per Choice Based Credit and Grading System)**

**From,**

**Academic Year 2016-17**

## **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. In line 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 is implemented for First Year of Master of Computer Applications (M.C.A.) from the academic year 20162017. Subsequently this system will be carried forward for Second Year and Third Year of M.C.A. in the academic years 2017 2018 and 20182019 respectively.

Dr. S. K. Ukarande

Co-ordinator,

Faculty of Technology,

Member Academic Council

University of Mumbai, Mumbai

## **Preamble:**

It is a privilege to present the revised Choice Based Credit and Grading System(CBCGS) syllabus of Master of Computer Applications (M.C.A.) for Sem I and Sem II (effective from year 2016-17) with inclusion of outcome based approach and project based learning. The syllabus is designed keeping in view the requirements of Industry. The basic objective of the syllabus is to equip the students with the necessary knowledge, skills and foundation required for Application development.

Since the M.C.A. programme is inclined more towards Application Development and thus has more emphasis on latest programming languages and tools to develop better and faster applications using integrated approach. For this, the integrated lab concepts like mini-projects are introduced in Sem I and Sem II. The syllabus of Sem I and Sem II include the combination of various subject in the area of Business Management, Mathematics and Information Technology.

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 (MCA)  
Mumbai University  
(With Effect from 2016-2017)  
Semester I**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA101	Object Oriented Programming	04	--	--	04	--	--	04
MCA102	Software Engineering & Project Management	04	--	--	04	--	--	04
MCA103	Computer Organization and Architecture	04	--	--	04	--	--	04
MCA104	IT in Management	04	--	--	04	--	--	04
MCA105	Statistics and Probability	04	--	--	04	--	--	04
MCAL101	Lab I – SEPM and OOP Lab	--	06	--	--	03	--	03
MCAL102	Lab II – Web Technologies and Mini Project-Lab	--	06	--	--	03	--	03
<b>Total</b>		<b>20</b>	<b>12</b>	<b>--</b>	<b>20</b>	<b>06</b>	<b>--</b>	<b>26</b>

Subject Code	Subject Name	Examination Scheme								
		Theory Course				End Sem. Exam.	Term Work	Pract.	Oral	Total
		Internal Assessment								
		Test1	Test 2	Avg.						
MCA101	Object Oriented Programming	20	20	20	80	--	--	--	100	
MCA102	Software Engineering & Project Management	20	20	20	80	--	--	--	100	
MCA103	Computer Organization and Architecture	20	20	20	80	--	--	--	100	
MCA104	IT in Management	20	20	20	80	--	--	--	100	
MCA105	Statistics and Probability	20	20	20	80	--	--	--	100	
MCAL101	Lab I – SEPM and OOP Lab	--	--	--	--	25	50	25	100	
MCAL102	Lab II – Web Technologies and Mini Project Lab	--	--	--	--	25	50	25	100	
<b>Total</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>400</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>700</b>	

**Program Structure for**  
**Master of Computer Application (MCA)**  
**Mumbai University**  
**(With Effect from 2016-2017)**  
**Semester II**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA201	Data Structures	04	--	--	04	--	--	04
MCA202	Operating System	04	--	--	04	--	--	04
MCA203	Computer Networks	04	--	--	04	--	--	04
MCA204	Financial accounting and Management	04	--	--	04	--	--	04
MCA205	Decision making and Mathematical Modelling	04	--	--	04	--	--	04
MCAL201	Lab I –OS and CN Lab	--	06	--	--	03	--	03
MCAL202	Lab II –DS and Web Application Development using Open source tools Lab	--	06	--	--	03	--	03
<b>Total</b>		<b>20</b>	<b>12</b>	<b>--</b>	<b>20</b>	<b>06</b>	<b>--</b>	<b>26</b>

Subject Code	Subject Name	Examination Scheme							
		Theory Course				Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test 2	Avg.					
MCA201	Data Structures	20	20	20	80	--	--	--	100
MCA202	Operating System	20	20	20	80	--	--	--	100
MCA203	Computer Networks	20	20	20	80	--	--	--	100
MCA204	Financial accounting and Management	20	20	20	80	--	--	--	100
MCA205	Decision making and Mathematical Modelling	20	20	20	80	--	--	--	100
MCAL201	Lab I – OS and CN Lab	--	--	--	--	25	50	25	100
MCAL202	Lab II –DS and Web Application Development using Open source tools Lab	--	--	--	--	25	50	25	100
<b>Total</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>400</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>700</b>

# SEMESTER I

## (2016-17)

Subject Code	Subject Name	Credits							
<b>MCA101</b>	<b>Object Oriented Programming</b>	<b>4</b>							
Subject Code	Subject Name	Teaching Scheme			Credits Assigned				
		Theory	Pract	Tut	Theory	TW	Tut.	Total	
<b>MCA101</b>	<b>Object Oriented Programming</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA101</b>	<b>Object Oriented Programming</b>	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 Understanding of C Programming Language  
 Knowledge of Algorithms and Control Flow of a program

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To Explore and Study Object oriented programming and advanced C++ concepts.
<b>CEO 2</b>	To Improve problem solving skills by applying object oriented techniques to solve bigger computing problems.
<b>CEO 3</b>	To provide a Strong foundation for advanced programming.

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

<b>MCA101.1</b>	Comprehend Object oriented programming concepts and their application
<b>MCA101.2</b>	To write applications using C++.
<b>MCA101.3</b>	Implement programming concepts to solve bigger problems.

## Syllabus

Sr. No.	Module	Detailed Contents	Hours
<b>1</b>	<b>Programming Basics</b>	Introduction to Programming, Programming Paradigms, Programming Languages and Types. Introduction to C - Basic Program Structure, Execution flow of C Program, Directives, Basic Input /Output Introduction to Object Oriented Programming- OOP concepts, Advantages, Applications, Comparison of C and C++-Data Types, Control Structures, Operators and Expressions	<b>8</b>
<b>2</b>	<b>Introduction to C++</b>	Structure of a C++ program, Execution flow, Classes and Objects, Access modifiers, Data Members, Member Functions, Inline Functions, Passing parameters to a Function(pass by Value, Pass by Address, Pass by Reference), Function with default arguments, Function Overloading, Object as a Parameter, Returning Object Static data members and functions, Constant Data members and functions Constructors- Default, Parameterized, Copy, Constructor Overloading, Destructors Arrays, Array as a Class Member, Array of Objects, Strings- Cstyle strings and String Class	<b>10</b>
<b>3</b>	<b>Operator Overloading and Pointers</b>	Operator Functions-Member and Non Member Functions, Friend Functions Overloading Unary operators Overloading binary operators(Arithmetic, Relational, Arithmetic Assignment, equality), Overloading Subscript operator Type Conversion Operators- primitive to Object, Object to primitive, Object to Object Disadvantages of operator Overloading, Explicit and Mutable Pointers, Pointer and Address of Operator, Pointer to an Array and Array of Pointers, Pointer arithmetic, Pointer to a Constant and Constant Pointer, Pointer Initialization, Types of Pointers(void, null and dangling), Dynamic Memory Allocation, Advantages and Applications of pointers	<b>10</b>
<b>4</b>	<b>Inheritance and Polymorphism</b>	Inheritance Concept, Protected modifier, Derivation of Inheritance- Public, Private and Protected, Types of Inheritance-Simple, Multilevel, Hierarchical, Multiple, Hybrid, Constructors and Inheritance, Function Overriding and Member hiding Multiple Inheritance, Multipath inheritance – Ambiguities and solutions Polymorphism, Static and Dynamic Binding, Virtual Functions, Pure Virtual Functions, Virtual destructors, Abstract Classes, Interfaces	<b>8</b>
<b>5</b>	<b>Streams and</b>	Files, Text and Binary Files, Stream Classes, File IO using	<b>8</b>



	<b>Exceptions</b>	Stream classes, File pointers, Error Streams, Random File Access, Manipulators, Overloading Insertion and extraction operators Error handling, Exceptions, Throwing and catching exceptions, Custom Exceptions, Built in exceptions	
<b>6</b>	<b>Advanced C++</b>	Casting- Static casts, Const Casts, Dynamic Casts, and Reinterpret Casts. Creating Libraries and header files. Namespaces Generic Programming, Templates, Class Templates, Function Templates, Template arguments, STL Database Programming with MySQL	<b>8</b>

### Reference Books:

1. The Complete Reference C, 4<sup>th</sup> Edition Herbert Sehlidt, Tata Mcgraw Hill
2. Object Oriented Programming in C++, 4<sup>th</sup> Edition, Robert Lafore, SAMS Techmedia
3. The Complete Reference-C++, 4<sup>th</sup> Edition. Herbert Schildt, Tata McGraw-Hill
4. The C++ Programming Language, 4<sup>th</sup> Edition, Bjarne Stroustrup, Addison Wesley
5. Starting Out with C++ Early Objects, 8<sup>th</sup> Edition, Tony Gaddis et al, Addison-Wesley
6. C++ How to Program, 8<sup>th</sup> Edition, Deitel and Deitel, Prentice Hall
7. Practical C++ Programming, 2<sup>nd</sup> Edition, Steve Quoline, O'reilly Publication
8. Absolute C++, 4<sup>th</sup> Edition, Walter Savitch, Pearson Education

### Web References:

1. <https://dev.mysql.com>
2. [www.github.com](http://www.github.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.

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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			
<b>MCA102</b>	<b>Software Engineering &amp; Project Management</b>					<b>04</b>			
Subject Code	Subject Name	Teaching Scheme			Credits Assigned				
		Theory	Pract	Tut					Theory
<b>MCA102</b>	<b>Software Engineering &amp; Project Management</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA 102</b>	<b>Software Engineering &amp; Project Management</b>	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:**

Knowledge of structured programming language and Application development.

**Course Educational Objectives (CEO):**

<b>CEO 102.1</b>	To understand the process of Software Engineering
<b>CEO 102.2</b>	To conceptualize the Software Development Life Cycle (SDLC) models.
<b>CEO 102.3</b>	To familiarize Project Management framework and Tools

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

<b>MCA102.1</b>	Apply use of knowledge of Software Life Cycle to successfully implement the projects in the corporate world.
<b>MCA102.2</b>	Identify the Inputs, Tools and techniques to get the required Project deliverable and Product deliverable using 10 Knowledge areas of Project Management.
<b>MCA102.3</b>	Implement Project Management Processes to successfully complete project in IT industry.

## Syllabus

Sr. No	Module	Detailed Contents	Hours
1	<b>Introduction to software engineering and project management</b>	Introduction to Software Engineering: Software, Evolving role of software, Three “R”-Reuse, Reengineering and Retooling, An Overview of IT Project Management: Define project, project management framework, The role of project Manager, Systems View of Project Management, Stakeholder management, Project phases and the project life cycle.	6
2	<b>Software Process Models</b>	Waterfall Model, Evolutionary Process Model: Prototype and Spiral Model, Incremental Process model: Iterative approach, RAD, JAD model, Concurrent Development Model, Agile Development: Extreme programming, Scrum.	6
3	<b>Software Requirement Analysis and Specification</b>	Types of Requirement, Feasibility Study, Requirement Analysis and Design: DFD, Data Dictionary, HIPO Chart, Warnier Orr Diagram, Requirement Elicitation: Interviews, Questionnaire, Brainstorming, Facilitated Application Specification Technique (FAST), Use Case Approach. SRS Case study, Software Estimation: Size Estimation: Function Point (Numericals). Cost Estimation: COCOMO (Numericals), COCOMO-II (Numericals). Earned Value Management.	11
4	<b>Software Project Planning</b>	Business Case, Project selection and Approval, Project charter, Project Scope management: Scope definition and Project Scope management, Creating the Work Breakdown Structures, Scope Verification, Scope Control.	8
5	<b>Project Scheduling and Procurement management</b>	Relationship between people and Effort: Staffing Level Estimation, Effect of schedule Change on Cost, Degree of Rigor & Task set selector, Project Schedule, Schedule Control, CPM (Numericals), Basic Planning Purchases and Acquisitions, Planning Contracting, Requesting Seller Responses, Selecting Sellers, Out Sourcing: The Beginning of the outsourcing phenomenon, Types of outsourcing relationship, The realities of outsourcing, Managing the outsourcing relationship.	6
6	<b>Software Quality</b>	Software and System Quality Management: Overview of ISO 9001, SEI Capability Maturity Model, McCalls Quality Model, Six Sigma, Formal Technical Reviews,	7 Hrs

		Tools and Techniques for Quality Control, Pareto Analysis, Statistical Sampling, Quality Control Charts and the seven Run Rule. Modern Quality Management, Juran and the importance of Top management, Commitment to Quality, Crosby and Striving for Zero defects, Ishikawa and the Fishbone Diagram.	
7	<b>Human Resource Management</b>	Human Resource Planning, Acquiring the Project Team: Resource Assignment, Loading, Leveling, Developing the Project Team: Team Structures, Managing the Project Team, Change management: Dealing with Conflict & Resistance Leadership & Ethics.	<b>4 Hrs</b>
8	<b>Software Risk Management and Reliability issues</b>	Risk Management: Identify IT Project Risk, Risk Analysis and Assessment, Risk Strategies, Risk Monitoring and Control, Risk Response and Evaluation. Software Reliability: Reliability Metrics, Reliability Growth Modeling.	<b>4 Hrs</b>

#### Reference Books:

1. Software Engineering, 5<sup>th</sup> and 7<sup>th</sup> edititon, by Roger S Pressman, McGraw Hill publication.
2. Managing Information Technology Project, 6edition, by Kathy Schwalbe, Cengage Learning publication.
3. Information Technology Project Management by Jack T Marchewka Wiley India publication.
4. Software Engineering 3<sup>rd</sup> edition by KK Agrawal, Yogesh Singh, New Age International publication.
5. Software Engineering Project Management by Richard H. Thayer Wiley India Publication.
6. Software Engineering for students: A Programming Approach by Douglas Bell, Pearson 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.

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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			
<b>MCA103</b>	<b>Computer Organization and Architecture</b>					<b>04</b>			
Subject Code	Subject Name	Teaching Scheme			Credits Assigned				
		Theory	Pract	Tut					Theory
<b>MCA103</b>	<b>Computer Organization &amp; Architecture</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA103</b>	<b>Computer Organization and Architecture</b>	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 Computer Fundamentals

**Course Educational Objectives (CEO):**

<b>CEO1</b>	To have a understanding of Digital systems and operation of a digital computer.
<b>CEO2</b>	To learn different architectures & organizations of memory systems, processor organization and control unit.
<b>CEO3</b>	To understand the working principles of multiprocessor and parallel organization's as advanced computer architectures

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

<b>MCA103.1</b>	Design trade-offs Basic fundamentals in digital logic & structure of a digital computer
<b>MCA103.2</b>	Identify performance issues in processor and memory design of a digital computer.
<b>MCA103.3</b>	To Develop independent learning skills and be able to learn more about different computer architectures and hardware.
<b>MCA103.4</b>	To articulate design issues in the development of Multiprocessor organization & architecture.

**Syllabus**

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>1</b>	<b>Fundamentals of Digital Logic</b>	Boolean Algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. Combinational Circuits : Adders, Mux, De-Mux, Sequential Circuits : Flip-Flops (SR, JK & D), Counters : synchronous and asynchronous Counter	<b>12</b>
<b>2</b>	<b>Computer System</b>	Comparison of Computer Organization & Architecture, Computer Components and Functions, Interconnection Structures. Bus Interconnections, Input / Output: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access	<b>06</b>
<b>3</b>	<b>Memory System Organization</b>	Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence. Virtual Memory, External Memory : Magnetic Discs, Optical Memory, Flash Memories, RAID Levels	<b>08</b>
<b>4</b>	<b>Processor Organization</b>	Instruction Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085/8086 CPU] , Processor Organization, Structure and Function. Register Organization, Instruction Cycle, Instruction Pipelining. Introduction to RISC and CISC Architecture, Instruction Level Parallelism and Superscalar Processors: Design Issues.	<b>12</b>
<b>5</b>	<b>Control Unit</b>	Micro-Operations, Functional Requirements, Processor Control, Hardwired Implementation, Micro-programmed Control	<b>04</b>
<b>6</b>	<b>Fundamentals of Advanced Computer Architecture</b>	Parallel Architecture: Classification of Parallel Systems, Flynn's Taxonomy, Array Processors, Clusters, and NUMA Computers. Multiprocessor Systems : Structure & Interconnection Networks, Multi-Core Computers: Introduction, Organization and Performance.	<b>08</b>
<b>7</b>	<b>Case Study</b>	Case study : Pentium 4 processor Organization and Architecture	<b>02</b>

#### **Reference Books:**

1. Modern Digital Electronics, R.P.Jain, 4e, Tata Mc Graw Hill.
2. Computer Organization & Architecture, William Stallings, 8e, Pearson Education.
3. Computer Architecture & Organization, John P. Hayes, 3e, Tata McGraw Hill.
4. Computer Organization, 5e, Carl Hamacher, Zconko Vranesic & Safwat Zaky, Tata McGraw Hill.
5. Digital Computer Fundamentals, Bartee C. Thomas , McGraw-Hill International Edition
6. Computer System Architecture, M. Morris Mano, Pearson Education.
7. Computer Architecture & Organization, Nicholas Carter, McGraw Hill.

8. Computer Architecture & Organization, 2e, Miles Murdocca & Vincent Heuring, Wiley India.

**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.

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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
<b>MCA104</b>	<b>IT in Management</b>	<b>4</b>

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	TW	Tut.	Total
<b>MCA104</b>	<b>IT in Management</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>

Subject Code	Subject Name	Examination Scheme							
<b>MCA104</b>	<b>IT in Management</b>	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 Information Technology

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	Understand Information Technology and its practices in managing the business.
<b>CEO 2</b>	Conceptualize the process of Technology acquisition in an Industry.
<b>CEO 3</b>	Familiar with impact and issues of Information Technology for managing business operations with social concern.

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

<b>MCA101.1</b>	To use various IT tools used for managing the Industrial operation.
<b>MCA101.2</b>	To apply the decision for selecting the proper IT tools for Management operation.
<b>MCA101.2</b>	To design the strategic plan for using Information Technology in Management



## Syllabus

<b>Sr. No.</b>	<b>Module</b>	<b>Detailed Contents</b>	<b>Hours</b>
<b>1</b>	<b>Information Technology Support and Application</b>	Introduction to Information Technology, Business Values Of IT, Role Of Computer in Modern Business, Current Trends, Business in Digital Economy.	<b>6</b>
<b>2</b>	<b>Information System and business applications</b>	Introduction to Information System: Information System, Classification and type of Information System, Information system Infrastructure and architecture, Role of Information systems in Business Today, Perspective on Information systems, Software and hardware platform to Improve Business Performance, Management opportunities challenges and Solutions, Business applications: Roles of IT in E-commerce, M-commerce.	<b>8</b>
<b>3</b>	<b>Acquisition of Information Technology</b>	Need to acquire technology, developing new technologies, Increasing strategic options, Gaining efficiency improvements, sources for acquiring technology, Responding to the competitive environment.	<b>8</b>
<b>4</b>	<b>Impact of Information Technology on organization and Strategic Issues of Information Technology</b>	Impact of Information Technology on organization : Modern Organizations ,Creating New Types of Organizations Strategic Issues of Information Technology: Information Technology and Corporate Strategy, Creating and Sustaining a Competitive Edge, Integrating Technology with the Business Environment, Managing Information Technology	<b>8</b>
<b>5</b>	<b>IT for managing International business and Governance</b>	International Business and IT technologies: International Business Strategies, Key Issues in International Environment, Managing IT Internationally. Governance concept: IT Governance, Internet governance, E-governance and internal IT processes.	<b>10</b>
<b>6</b>	<b>Information Technology Issues For Management</b>	Management in a Technological Environment, The Changing World of Information Action Plan	<b>6</b>
<b>7</b>	<b>Societal Implications And The Future With Technology</b>	Social Responsibilities, Ethics and Information Technology, The Future with Information Technology	<b>6</b>

## Reference Books

1. Information Technology For Management – Transforming Organizations in Digital Economy by EFRAIM Turban, Dorothy Leidner (WILEY Student Edition)
2. Information Technology For Management by B. MuthuKumaran (OXFORD University Press)
3. INFORMATION TECHNOLOGY FOR MANAGEMENT 7th ed Authors **Henry C Lucas,Mc Graw Hill Publications.**
4. Information Technology For Management by Dr. CH. Seetha Ram.
5. Technology Acquisition ,A guided approach to technology acquisition and protection decision by Mortara and Ford.
6. Business Intelligence: Practices, Technologies, and Management- Rajiv Sabherwal, Irma Becerra-Fernandez
7. Managing and using Information Systems, K E Pearlson, C S Saunders, Wiley India

## 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.

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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
<b>MCA105</b>	<b>Statistics And Probability</b>	<b>04</b>

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	TW	Tut.	Total
<b>MCA105</b>	<b>Statistics And Probability</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>

Subject Code	Subject Name	Examination Scheme							
<b>MCA105</b>	<b>Statistics And Probability</b>	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 Mathematics, combinatorics and calculus Knowledge.

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To equip the students with a working knowledge of probability, statistics, and modeling in the presence of uncertainties.
<b>CEO 2</b>	To understand the concept of hypothesis and significance tests
<b>CEO 3</b>	To help the students to develop an intuition and an interest for random phenomena and to introduce both theoretical issues and applications that may be useful in real life.

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

<b>MCA105.1</b>	Distinguish between quantitative and categorical data
<b>MCA105.2</b>	Apply different statistical measures on data
<b>MCA105.3</b>	Identify, formulate and solve problems
<b>MCA105.4</b>	Classify different types of Probability and their fundamental applications

## Syllabus

Sr. No	Module	Detailed Contents	Hours
1	<b>Measures of Central Tendency &amp; Measures of Dispersion</b>	Frequency Distribution, Histogram, Stem and leaf diagram, ogives, Frequency Polygon, Mean, Median, Mode, Range, Quartile Deviation, Mean Deviation, Box whisker plot, Standard Deviation, Coefficient of Variation	8
2	<b>Skewness, Correlation &amp; Regression</b>	Karl Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Scatter Diagram, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Linear Regression and Estimation, Coefficients of regression	8
3	<b>Theory of Attributes</b>	Classes and Class Frequencies, Consistency of Data, Independence of Attributes, Association of Attributes	4
4	<b>Testing of Hypothesis</b>	Hypothesis, Type I and Type II errors. Tests of significance – Student's t-test: Single Mean, Difference of means, paired t-test, Chi-Square test: Test of Goodness of Fit, Independence Test	10
5	<b>Introduction to Probability</b>	Random experiment, Sample space, Events, Axiomatic Probability, Algebra of events	4
6	<b>Conditional Probability</b>	Conditional Probability, Multiplication theorem of Probability, Independent events, Baye's Theorem	6
7	<b>Random variables</b>	Discrete random variable, Continuous random variable, Two-dimensional random variable, Joint probability distribution, Stochastic independence	7
8	<b>Mathematical Expectation</b>	Expected value of a random variable, Expected value of a function of a random variable, Properties of Expectation and Variance, Covariance	5

### Reference Books:

1. Fundamentals of Mathematical Statistics – 1<sup>st</sup> Edition S.C.Gupta, V.K.Kapoor, S Chand
2. Introduction to Probability & Statistics – 4<sup>th</sup> Edition J.Susan Milton, Jesse C. Arnold Tata McGraw Hill
3. Fundamentals of Statistics : 7<sup>th</sup> edition S C Gupta, Himalaya Publishing house
4. Probability and Statistics with Reliability, Queuing, And Computer Science Applications (English) 1st Edition: Kishore Trivedi, PHI
5. Schaum's Outlines Probability, Random Variables & Random Process 3<sup>rd</sup> Edition Tata McGraw Hill
6. Probability & Statistics for Engineers: Dr J Ravichandran, Wiley
7. Statistics for Business and Economics: Dr Seema Sharma, Wiley
8. Applied Business Statistics 7<sup>th</sup> Edition Ken Black, 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.**

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
<b>MCA L101</b>	<b>Lab 1-SEPM and OOP Lab</b>	--	<b>06</b>	--	--	<b>03</b>	--	<b>03</b>
Examination Scheme								
End Sem. Exam. [ Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total
<b>MCA L101</b>	<b>Lab 1-SEPM and OOP Lab</b>				<b>25</b>	<b>50</b>	<b>25</b>	<b>100</b>

**Pre-requisites:**

Basic Understanding of C Programming Language  
 Knowledge of Algorithms and Control Flow of a program

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To Understand Concepts of Object oriented programming and basics of Software Engineering
<b>CEO 2</b>	To learn how C++ supports Object Oriented Principles.
<b>CEO 3</b>	To Study Design of reliable and maintainable Object Oriented Applications using an Integrated Software Engineering Approach.

**Course Outcomes: Students will be able to:**

<b>MCA L101.1</b>	Design and Develop the solution to a problem using Object Oriented Programming Concepts
<b>MCA L101.2</b>	Demonstrate use of C++ Concepts
<b>MCA L101.3</b>	Develop real time applications.

Sr. No.	Module	Detailed Contents	Hours
<b>1</b>	<b>Programming Basics</b>	Basic Programs using C Programming Assignments using Control Structures Logic Building Programming Assignments	<b>8</b>
<b>2</b>	<b>Introduction to C++</b>	Programming Assignments Using Classes Programming Assignments using Static members and Methods Programming Assignments using Constant members and Methods Programming Assignments using Arrays and Strings	<b>8</b>
<b>3</b>	<b>Operator Overloading and Pointers</b>	Programming Assignments to Overload Operators Programming Assignments for Data Conversions Programming Assignments Using Pointers	<b>8</b>

4	<b>Inheritance and Polymorphism</b>	Programming Assignments based on Inheritance and Polymorphism	8
5	<b>Streams and Exceptions</b>	Programming Assignments based on Streams and Exceptions	8
6	<b>Advanced C++</b>	Programming Assignments based on Templates Case Study- Database Connectivity using MySQL	8
7	<b>SRS</b>	Business Case Software Requirement Specification (SRS to be attached for any sample project)	4
8	<b>Scheduling Tools and WBS</b>	Introduction to Project Scheduling tools (any open source softwares) Creating a Project Plan or WBS Establishing the Project Start or Finish Date Entering Tasks Attach Supporting Information Entering Task Durations Setting Task Constraints (Milestones) Gantt chart Pert/CPM chart	8
9	<b>Resource Management</b>	Resource Management (using open source tool) Managing Project Cost	4
10	<b>Cost Estimation and Quality Standards</b>	Solving examples using COCOMO and COCOMO II models, CPM numerical Case studies on Quality Standards	4
11	<b>A Mini Project</b>	It is based on OOP and SE PM using an integrated approach (Maximum two students in a group)	10

### Reference Books:

1. The Complete Reference C, 4<sup>th</sup> Edition Herbert Schildt, Tata Mcgraw Hill
2. Object Oriented Programming in C++, 4<sup>th</sup> Edition, Robert Lafore, SAMS Techmedia
3. The Complete Reference-C++, 4<sup>th</sup> Edition. Herbert Schildt, Tata McGraw-Hill
4. The C++ Programming Language, 4<sup>th</sup> Edition, Bjarne Stroustrup, Addison Wesley
5. Starting Out with C++ Early Objects, 8<sup>th</sup> Edition, Tony Gaddis et al, Addison-Wesley
6. C++ How to Program, 8<sup>th</sup> Edition, Deitel and Deitel, Prentice Hall
7. Practical C++ Programming, 2<sup>nd</sup> Edition, Steve Quoline, O'reilly Publication
8. Absolute C++, 4<sup>th</sup> Edition, Walter Savitch, Pearson Education
9. Software Engineering, 5th and 7th edition, by Roger S Pressman, McGraw Hill publication.
10. Managing Information Technology Project, 6 edition, by Kathy Schwalbe, Cengage Learning publication.
11. Information Technology Project Management by Jack T Marchewka Wiley India publication.
12. Software Engineering 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication.
13. Software Engineering Project Management by Richard H. Thayer Wiley India Publication.

14. Software Engineering for students: A Programming Approach by Douglas Bell, Pearson publication.

**Web References:**

1. <https://dev.mysql.com>
2. [www.github.com](http://www.github.com)



Subject Code	Subject Name	Teaching Scheme (Contact Hours per Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
<b>MCA L102</b>	<b>Lab-II: Web Technologies and Mini Project Lab</b>	---	<b>06</b>	---	---	<b>03</b>	---	<b>03</b>
Examination Scheme								
End Semester Exam [Once in a Semester]								
Laboratory Name					Term Work	Practical	Oral	Total
<b>MCAL102: Lab-II: Web Technologies and Mini Project Lab</b>					<b>25</b>	<b>50</b>	<b>25</b>	<b>100</b>

**Pre-requisites:** Basic understanding of programming fundamentals

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To study the concept and architecture of World Wide Web.
<b>CEO 2</b>	To learn web application development using open source technology.
<b>CEO 3</b>	To provide skills to design and develop dynamic web sites.

**Course Outcomes: At the end of the course student will be able to**

<b>MCA L102.1</b>	Acquire knowledge about functionality of world wide web
<b>MCA L102.2</b>	Develop web based applications using open source technology.
<b>MCA L102.3</b>	Design and develop dynamic web sites.

**Syllabus**

Sr. No.	Module	Detailed Contents	Hours
<b>1.</b>	<b>Introduction to the Web Technologies</b>	Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers.	<b>06</b>
<b>2.</b>	<b>HTML</b>	Basics of HTML, Structure of HTML code, formatting and fonts, color, hyperlink, lists, tables, images (Programming Assignments based on above topics)	<b>12</b>
<b>3.</b>	<b>Style Sheets</b>	Need for CSS, introduction to CSS, basic syntax and structure, Classes and Pseudo Classes, CSS tags for setting background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning etc. (Programming Assignments based on above topics)	<b>12</b>
<b>4.</b>	<b>Introduction to PHP</b>	Configuration and Installation of PHP, basic syntax of PHP, Expressions, Statements, Arrays, Functions, string, Regular Expressions, Date and Time Functions	<b>12</b>

		(Programming Assignments based on above topics)	
<b>5.</b>	<b>PHP and MySQL</b>	File Handling- Creating a File, Reading from Files, Copying Files, Moving File, Deleting File, Updating File, Uploading Files, Form Designing using HTML 5, Validation's using PHP Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, Master-Detail relationships using Joins. Session Management- Using Cookies in PHP, HTTP Authentication, Using Sessions (Programming Assignments based on above topics)	<b>10</b>
<b>6</b>	<b>Mini Project</b>	A Mini – Project based on DS and WAD using an integrated approach.(Maximum Two students in a Group)	<b>26</b>

Reference Books:

1. Web Technologies, Black Book, dreamtech Press
2. HTML 5, Black Book, dreamtech Press
3. Learning PHP, MySQL, JavaScript, CSS and HTML 5, Robin Nixon, O'Reilly publication
4. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill
5. Professional PHP Programming, Jesus Caspagnetto, Etal. Wrox Publication.
6. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel, Pearson
7. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India

# SEMESTER II

## (2016-17)

Subject Code	Subject Name					Credits			
<b>MCA201</b>	<b>Data Structures</b>					<b>04</b>			
Subject Code	Subject Name	Teaching Scheme			Credits Assigned				
		Theory	Pract	Tut					Theory
<b>MCA201</b>	<b>Data Structures</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA 201</b>	<b>Data Structures</b>	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:**

Understanding of Algorithms

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To teach efficient storage mechanisms of data for an easy access.
<b>CEO 2</b>	To design and implement various basic and advanced data structures.
<b>CEO 3</b>	To introduce various techniques for representation of the data in the real world.

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

<b>MCA201.1</b>	Analyze and compute efficiency of various algorithms.
<b>MCA201.2</b>	Effectively choose the data structure that efficiently model the information in a problem
<b>MCA201.3</b>	Describe how Linear data structures are represented in memory and used by algorithms and their applications
<b>MCA201.4</b>	Identify the benefits of Non-linear Data Structures and their applications

## Syllabus

Sr	Module	Detailed Contents	Hours
1	<b>Introduction to Data Structures &amp; Algorithms</b>	Introduction of Data structures, Abstract Data Types, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notations (Big O, Omega, Theta), Performance measurement, Divide and Conquer, Back Tracking Method, Dynamic programming	4
2	<b>Sorting and searching algorithms</b>	Bubble sort, Insertion sort, Radix Sort, Quick sort, Merge sort, Heap sort, Selection sort, shell Sort, Linear Search, Sequential search, Binary search	6
3	<b>Hashing</b>	Different Hashing Techniques, Address calculation Techniques, Common hashing functions, Collision resolution techniques: Linear probe, Quadratic probe, Key offset. Rehashing, Double hashing, Link list addressing.	8
4	<b>Linear Data Structures</b>	Stack Definition, Operations, Implementation of Stacks (Array and Linked list) and applications-Evaluation of postfix expression, Balancing of parenthesis Queue: Definition, Operations, Implementation of simple queue (Array and Linked list) and applications of queue-BFS Types of queues: Circular, Double ended, Priority, Implementation using linked list Types of Linked List: Singly, Doubly and Circular Linked list Definition, Operations (Insert, delete, traverse, count, search ) Applications of Linked List: Polynomial Addition and Subtraction	14
5	<b>Non-linear Data Structures</b>	Tree Definition and concepts, General Tree- Definition, Insertion and Deletion into general tree, Binary Tree- Definition, Insertion and Deletion into binary tree, Traversal of a binary tree, Reconstruction of a binary tree from traversal, Conversion of general tree into binary tree, Huffman tree, Expression tree, Binary threaded tree Binary Search Tree- Definition, Operation, Implementation AVL tree- Definition, AVL tree rotation with examples, Heaps-Definition, Operations (insertion, delete, build) M way Tree- Introduction, B tree-definition and examples and B*	14
6	<b>Graphs</b>	Definition, Types, Operations, Representation, Networks, Traversals of graph, Minimum spanning tree, Kruskal's Algorithm, Prim's Algorithm, Warshall's Algorithm, Shortest path algorithm-dijkstra's algorithm	6

## Reference Books

1. Richard F Gilberg Behrouz A Forouzan , “Data Structure A Pseudocode Approach with C“. Second edition
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to ALGORITHMS”, PHI, India Second Edition.
3. Shaum’s Outlines Data Structure Seymour Lipschutz TMH
4. Michael T.Goodrich “Data Structures and Algorithms in C++-“ Wiley Publications

**Theory paper** will be of **80** marks. **Internal** assessment will be of **20** marks, which will be the average of two tests (T1 and T2) of 20 marks each.

**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.**

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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			
<b>MCA202</b>	<b>Operating System</b>					<b>4</b>			
Subject Code	Subject Name	Teaching Scheme				Credits Assigned			
		Theory	Pract	Tut	Theory	TW	Tut.	Total	
<b>MCA 202</b>	<b>Operating System</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA 202</b>	<b>Operating System</b>	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:** Computer Organization and Architecture

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To teach Operating system design
<b>CEO 2</b>	To understand the process concurrency and synchronization, deadlocks and various memory management policies.
<b>CEO 3</b>	To teach the concepts of input/output, storage and file management
<b>CEO 4</b>	To teach various protection and security mechanisms and to study and compare different operating systems & their features.

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

<b>MCA202.1</b>	Classify different styles of operating system designs
<b>MCA202.2</b>	Analyze process management, I/O management, memory management functions of Operating System
<b>MCA202.3</b>	Employ process scheduling and disk scheduling algorithms.
<b>MCA202.4</b>	Explore file management and protection and security concepts.

## Syllabus:

Sr No	Module	Detailed Contents	Hours
1	<b>Introduction to System Software &amp; operating System</b>	Introduction to System Software & operating System Overview of all system softwares: Compiler, Assembler, Linker, Loader, Operating system, OS services and Components, Types of OS-Batch, multiprocessing, multitasking, timesharing, Distributed OS ,Real time OS, virtual machines, System Calls ,types of System calls, Buffering, Spooling	5
2	<b>Process and Thread Management</b>	Process and Thread Management: - Concept of process and threads, Process states, Process management, Context switching, Interaction between processes and OS, Multithreading, CPU scheduling algorithms, multiprocessor scheduling algorithms, Real time scheduling algorithms	10
3	<b>Concurrency Control</b>	Concurrency Control: Concurrency and Race Conditions, Mutual exclusion requirements, Software and hardware solutions, Semaphores, Monitors, Classical IPC problems and solutions, Deadlock, Characterization, Detection, Recovery, Avoidance and Prevention	8
4	<b>Memory Management</b>	Memory Management: Memory partitioning, Swapping, Paging, Segmentation, Virtual memory, Overlays, Demand paging, Performance of Demand paging, Virtual memory concepts, Page replacement algorithms, Allocation algorithms	9
5	<b>Mass Storage Structure</b>	Mass Storage Structure: Secondary-Storage Structure, Disk structure, Disk scheduling, Disk management, Swap-space management, Disk reliability, Stable storage implementation, Introduction to clock, Clock hardware, Clock software	7
6	<b>File systems</b>	File systems: File concept, File support, Access methods, Allocation methods, Directory systems, File protection, Free space management	4
7	<b>Protection &amp; Security</b>	Protection & Security: Protection- Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights Security- The security problem, Authentication, One-Time passwords, Threats	4
8	<b>Case Study</b>	Case Study : Study of different Operating, Systems(Linux, Windows, Android OS, iOS)	5

### Reference Books

1. Operating System Concepts (9th Ed) by Silberschatz and Galvin, Wiley, 2000.
2. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall, 2000.
3. Modern Operating Systems by Andrew S Tanenbaum, Prentice Hall India, 1992.
4. Operating Systems (3rd edition) by Gary Nutt, NabenduChaki, SarmishthaNeogy, Pearson



5. Operating Systems Design & Implementation Andrew S. Tanenbaum, AlbertS. Woodhull Pearson
6. Operating Systems Achyut S. Godbole Tata McGraw Hill
7. Operating Systems D.M.Dhamrdhere Tata McGraw Hill

**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.**

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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		
<b>MCA 203</b>	<b>Computer Networks</b>						<b>4</b>		
Subject Code	Subject Name	Teaching Scheme			Credits Assigned				
		Theory	Pract	Tut	Theory	TW	Tut.	Total	
<b>MCA203</b>	<b>Computer Networks</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>	
Subject Code	Subject Name	Examination Scheme							
<b>MCA 203</b>	<b>Computer Networks</b>	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:**

Digital Computer Fundamentals and computer architecture.

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To help learners get a grounding of basic network components and architecture.
<b>CEO 2</b>	To explore basic networking models.
<b>CEO 3</b>	To learn the way protocols are used in networks and their design issues.

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

<b>MCA203.1</b>	Comprehend the basic concepts of computer networks and data communication systems.
<b>MCA203.3</b>	Analyze basic networking protocols and their use in network design
<b>MCA203.3</b>	Explore various advanced networking concepts.

## Syllabus

Sr. No	Module / Unit	Detailed Contents	Hours
1	<b>Basics of Digital Communication</b>	Introduction to digital communication, Signal propagation, Signal types, Signal parameters , Switching & forwarding, Transmission impairments, Attenuation, Delay distortion, Noise, Effects of limited bandwidth, Data rate limits-Nyquist's theorem and Shannon's theorem.	<b>05</b>
2	<b>Network Organization and Models</b>	Basics of computer Network, topology & types of topologies, types of networks(LAN, MAN, WAN), Concept of Intranet & Extranet, Ad-Hoc Networks, types of communications (Asynchronous and synchronous) , modes of communications (simplex, half duplex, full duplex), Protocols, Networking models, ISO-OSI Reference Model, Design issues of the layer ,Internet Model (TCP/IP), Comparison of ISO-OSI & TCP/IP Model	<b>06</b>
3	<b>Networking Devices</b>	Connectivity Devices : Passive & Active Hubs, Repeaters, , Switches (2-Layer Switch, 3-Layer switch(Router), Bridges (Transparent Bridges, Spanning Tree, Bridges, Source Routing Bridges) , Routers, Gateways.	<b>04</b>
4	<b>Application, Presentation &amp; Session Layer</b>	Principles of Application Layer Protocols, The Web and HTTP, FTP, Telnet, Electronic Mail in the Internet (SMTP, MIME, POP3, IMAP), DNS, Introduction to SNMP.	<b>06</b>
5	<b>Transport layer</b>	Transport-Layer Services, port addressing, Multiplexing and Demultiplexing, Principles of Reliable Data Transfer, Congestion Control, TCP's Congestion Control. Quality of Service : Introduction, Queue Analysis, QoS Mechanisms, Queue management Algorithms, Feedback, Resource, Reservation.	<b>10</b>
6	<b>Network layer</b>	Network Service Model, Data gram & Virtual Circuit , Routing Principles, The Internet Protocol,(ipv4 & ipv6) , IP addressing and subnetting, Routing Algorithms., Hierarchical Routing, Routing in the Internet: Intra and inter domain routing; Unicast Routing Protocols RIP, OSPF, BGP, Multicast Routing Protocols : MOSPF, DVMRP. ATM Networks: Need for ATM, ATM Layers, ATM adaptation Layers, IP over ATM, Multi protocol Label switching (MPLS), Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes	<b>11</b>
7	<b>Data Link Layer</b>	Data Link Layer, Error Detection and Correction Techniques, Multiple Access Protocols, LAN Addresses and ARP & RARP , PPP: The Point-to-Point Protocol , Ethernet standards – IEEE 802.3, 802.5, FDDI, 802.6.	<b>08</b>
8	<b>Physical layer</b>	Physical Layer, Types of media wired and wireless media	<b>02</b>

**Reference Books:**

1. Computer Networking: A Top-Down Approach Featuring the Internet , J. F. Kurose and K. W. Ross, Seventh Edition, Addison-Wesley.
2. Computer Networks: Principles, Technologies and Protocols for Network design, N. Olifer and V. Olifer, Wiley India
3. Data Communication and Networking, B. A. Forouzan, Fourth Edition, McGraw Hill.
4. Computer Networks, Andrew Tenenbaum, Fifth Edition, PHI .
5. TCP/IP Protocol Suite, B. A. Forouzan, Third Edition, Tata McGraw Hill edition.
6. Data and Computer Communications, William Stallings, Ninth Edition, 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.**

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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			
<b>MCA204</b>	<b>Financial Accounting and Management</b>						<b>4</b>			
Subject Code	Subject Name	Teaching Scheme			Credits Assigned					
		Theory	Pract	Tut	Theory	TW	Tut.	Total		
<b>MCA204</b>	<b>Financial Accounting and Management</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>		
Subject Code	Subject Name	Examination Scheme								
<b>MCA204</b>	<b>Financial Accounting and Management</b>	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:**

Some basic knowledge of accounting and good mathematical skills is recommended.

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	Introduce the principles, concepts, and applications of financial accounting and management.
<b>CEO 2</b>	Explore, and use the accounting concepts emphasizing how financial statements communicate information about the business corporation's performance and position for users internal and external to management.
<b>CEO 3</b>	To introduce the underlying framework and concepts of Financial Accounting and Management and how these fit into the current global business scenario.

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

<b>MCA204.1</b>	To use accounting functions as an information development and communication system that supports economic decision making and provides value to entities and
<b>MCA204.2</b>	Preparation of financial statements and related information and apply analytical tools in making both business and financial decisions.
<b>MCA204.3</b>	To analyze the impact of accounting system on several business functions and managers' decision making.
<b>MCA204.4</b>	To analyze and use financial statements; prepare budgets and investment options; assess risks and the rewards involved in firm's financial decisions.

**Syllabus**

<b>Sr No.</b>	<b>Module</b>	<b>Detailed Contents</b>	<b>Hours</b>
1	<b>Introduction to Accounting</b>	Introduction to Accounting:- Principles, Concepts, Double entry system of accounting, introduction to journal, voucher, ledger; preparation of trial balance, final accounts , trading and profit and loss account and balance sheet.(theory and numerical)  Accounting Standards - AS1, AS2, AS3,AS9(only Theory), IFRS (International Financial Reporting Standards)	<b>12</b>
2	<b>BEA and Budgeting</b>	Break-even Analysis:-Concept of Break Even Point, Cost-Volume-Profit Analysis, Determination of Break Even Point, Margin of Safety and PV ratio, Impact of changes in Cost or selling price on BEP - Practical applications of Break-even Analysis. Budgeting: Budgeting-cash budget (theory and numerical), sales budget – flexible Budgets and master budgets (theory).	<b>12</b>
3	<b>Financial Management Concepts</b>	Financial Management:-Meaning and scope, Objectives of time value of money, goals of FM, profit vs. value maximization. Leverages – operating, financial, composite.; cost of equity, preference and equity shares, bonds and debentures, weighted average cost of capital, capital gearing fundamentals.	<b>10</b>
4	<b>Tools and Techniques of FM</b>	Tools and Techniques for Financial Statement Analysis:- Ratio Analysis – Classification of Ratios – Short term solvency and long term solvency – Profitability ratios - Analysis and Interpretation of Financial Statements through ratios of Liquidity, Solvency and Profitability. Fund Flow Statement - Meaning, Importance, Statement of changes in working capital and statement of Sources and application of funds. Cash flow Analysis:- cash flow Statements: Preparation, Analysis and interpretation, (only theory)	<b>10</b>

5	<b>Capital Budgeting Concepts</b>	Capital Budgeting:- Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method; purpose of capital budgeting, capital budgeting process, and types of capital investment decisions. Accounting Rate of Return (ARR) and Net Present Value Method (simple numerical problems on these).	<b>8</b>
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**Reference Books:**

1. Dr. Kapil Jain, Prof. Rashmi Somani, “Accounting for Managers”, Dreamtech Press, 2015
2. S N Maheshwari, “Accounting for Management”, Vikas Publishing, 3<sup>rd</sup> edition
3. Prasanna Chandra, “Financial Management Theory and Practices”, TMH, 9<sup>th</sup> edition
4. Weygandt, Himmel, Kiesco, “Accounting Principles”, 12<sup>th</sup> Edition, Wiley Publication.
5. Khan & Jain, “Financial Management”, Mc Graw Hill
6. Siddiqui S.A. Siddiqui, “Managerial Economics & Financial Analysis”, A.S. New Age.
7. V Sharan, “Fundamentals of Financial Management”, 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.

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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
<b>MCA205</b>	<b>Decision Making and Mathematical Modeling</b>	<b>4</b>

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract	Tut	Theory	TW	Tut.	Total
<b>MCA205</b>	<b>Decision Making and Mathematical Modelling</b>	<b>04</b>	--	--	<b>04</b>	--	--	<b>04</b>

Subject Code	Subject Name	Examination Scheme							
<b>MCA205</b>	<b>Decision Making and Mathematical Modelling</b>	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 mathematics

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To Understand the fundamental ideas of Discrete Mathematics
<b>CEO 2</b>	To Express the decision making concepts as a mathematical model
<b>CEO 3</b>	To Study and identify a real life business problem and computing requirements appropriate to its solution

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

<b>MCA205.1</b>	Develop mathematical and logical thinking
<b>MCA205.2</b>	Model situations from variety of settings in generalised mathematical form
<b>MCA205.3</b>	Solve the real world business problem



## Syllabus

Sr	Module	Detailed Contents	Hours
1	<b>Mathematical logic</b>	Propositions and logical operations, Conditional Statements , Methods of Proof , Mathematical Induction, Mathematical Statements , Logic and Problem Solving, Normal Forms	8
2	<b>Sets and Relations</b>	Set operations and functions, Product sets and partitions, Relations and digraphs, Paths in Relations and Digraphs, Properties of Relations , Equivalence Relations, Operations on Relations, Partially Orders Sets, Hasse diagram	10
3	<b>Graphs</b>	Graph, Representation of Graph, Adjacency matrix, Adjacency list, Euler paths and Circuits, Hamiltonian Paths and Circuits	5
4	<b>Mathematical Models</b>	Mathematical Models - Vehicular Stopping Distance Modelling using decision theory : Probability and Expected Value (e.g. Rolling the Dice, Life Insurance, Roulette etc) Decision Trees , Classification problems using Bay's theorem	8
5	<b>Modeling using difference equation</b>	Recurrence relation - Fibonacci series, Tower of Hanoi ,Lines in a plane Homogenous linear equations with constant coefficients, Particular Solution, Total Solution, Divide and Conquer Recurrence Relations (Fast Multiplication of Integers, Fast matrix Multiplication)	10
6	<b>Characteristics of Complex Business Problems</b>	Number of Possible Solutions, Time-Changing Environment, Problem-Specific Constraints, Multi-objective Problems, Modeling the Problem A Real-World Examples,	4
7	<b>MADM &amp; MCDM</b>	Introduction to Multiple Attribute Decision-making (MADM) Multiple Attribute Decision-making Methods, Simple Additive Weighting (SAW) Method, Weighted Product Method (WPM), Analytic Hierarchy Process (AHP) Method, Entropy Method, Compromise Ranking Method (VIKOR), Weighted Average Method (WAM) Introduction to Multiple Criteria Decision Making (MCDM)	7

## Reference Books

1. Discrete Mathematics and Its Applications 4<sup>th</sup> Edition , Kenneth H. Rosen ,McGraw Hill
2. A First Course in Mathematical Modeling 5<sup>th</sup> Edition, Frank R. Giordano, William P. Fox, Steven B. Horton
3. Adaptive Business Intelligence,F 1<sup>st</sup> Edition by Zbigniew Michalewicz, Martin Schmidt, Matthew Michalewicz, ConstantinChiriatic, Springer Publication
4. Decision Making in the Manufacturing Environment Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods,1<sup>st</sup> Edition by R. VenkataRao, Springer Publication
5. Discrete Mathematical structures 4<sup>th</sup> Edition, Kolman, Busby, Ross, PHI

6. Discrete Mathematics : Seymour Lipschutz, Varsha Patil II<sup>nd</sup> Edition Schaum's Series TMH
7. Data Mining: Introductory and Advanced Topics ,3rd Edition, Dunham , Sridhar

**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.**

1. Question paper will comprise of total six questions.
2. Question Number One should be compulsory.
3. All question carry equal marks.
4. Students can attempt any three from the remaining.
5. 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	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
<b>MCA L201</b>	<b>Operating System and Computer Networks Lab (OS and CN Lab)</b>	--	<b>06</b>	--	--	<b>03</b>	--	<b>03</b>
Examination Scheme								
End Sem. Exam. [ Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total
<b>MCA L201</b>	<b>Operating System and Computer Networks Lab (OS and CN Lab)</b>				<b>25</b>	<b>50</b>	<b>25</b>	<b>100</b>

**Pre-requisites: Basic overview of Computer and Computer Networking principles.**

**Course Educational Objectives (CEO):**

<b>CEO 1</b>	To study the various user level and administrator level commands in operating system.
<b>CEO 2</b>	To learn shell script and AWK programming.
<b>CEO 3</b>	To make the learner aware of the practical issues and various networking devices with their interconnections and configurations.
<b>CEO 4</b>	To equip the learner with a hands-on experience of designing various networking applications.

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

<b>MCAL201.1</b>	Apply various operating system commands.
<b>MCAL201.2</b>	To write a shell script and awk programming.
<b>MCAL201.3</b>	Design network for any business requirement.

**Syllabus :**

Sr.No.	Session	Contents	Hrs
<b>1</b>	<b>Operating System Basics</b>	Installation of Operating System with configuration, Disk fragmentation & partitioning, Linux introduction and file system - Basic Features, Advantages, Installation requirements, Basic Architecture of Unix/Linux system, Kernel, Shell, System administration Commands	<b>4</b>

2	<b>Basic OS Commands</b>	Basic commands, Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, more, less, Creating and viewing files using 'cat', File comparisons, View files. Essential Linux commands. Understanding shells, Processes in Linux-process fundamentals, connecting processes with pipes, Redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep, Printing commands, find, wc, Cal, banner, touch, file, dd, Mathematical commands- bc, expr, factor, units. vi, vim editor	8
3	<b>Filter Commands</b>	Filter related commands-sort, grep, sed, head, tail, cut, paste, uniq Disk commands-disk related commands, checking disk free spaces	8
4	<b>Shell Programming</b>	Shell programming :- Shell programming, Basic of shell programming, Various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, shell keywords, Creating Shell programs for automate system tasks and report printing, use of grep in shell	8
5	<b>Advanced Shell Scripting</b>	Advanced Shell scripting-basic script functions, returning a value, using variables in functions, array and variable functions, function recursion, creating text menus	6
6	<b>Awk programming</b>	Study of gcc & basic Awk Programming-variables, expressions, built in variables , printf, storing in a file using -f option, comparison operator, BEGIN and END sections Awk Programming-arrays, functions, if statement, looping	8
7	<b>OS Security</b>	Securing Linux on a network-managing network services, controlling access to networks with nmap, implementing firewalls	4
8	<b>Introduction to packet tracer</b>	Study of Packet Tracer software interface, Basic Configuration of console, Router & Switches, Assigning IP v4 & IP v6 addresses to the interfaces of the routers, Subnetting /notation	4
9	<b>Routing Techniques</b>	Configure Static and default routing, RIPv2, EIGRP, OSPF	4
10	<b>Dynamic configuration</b>	Configuration of DCHP , Access List Configuration, Configuration of NAT, Static, Dynamic and PAT	6
11	<b>Authentication and VLAN</b>	Configuration of PPPoE (PAP, CHAP), Configure VLANs on the router, InterVLAN, Router on stick, multilayer VLAN, Spanning tree.	4
14	<b>Network Protocol</b>	Configure Telnet, DNS, HTTP, SMTP , FTP Servers, SNMP	4
15	<b>Mini Project</b>	A Mini – Project based on OS and CN using an integrated approach.(Maximum Two students in a Group)	10

**Reference Books:-**

1. Unix – Concepts & Applications, Sumitabha Das, Fourth Edition, McGraw Hill Education.
2. Unix Shell Programming – Yashwant Kanetkar, BPB Publications.
3. Linux Bible, Christopher Negus, Ninth Edition, Wiley Publications
4. Linux Command Line and Shell Scripting Bible, Third Edition, Richard Blum and Christine Bresnahan, Wiley Publications
5. Linux Programming A Beginner's Guide – Richard Petersen, Tata McGraw Hill Education
6. Cisco CCENT/CCNA ICND1 100-101 Official Cert Guide, Wendell Odom, CISCO Press
7. CCNA Routing and Switching ICND2 200-101 Official Cert Guide, Wendell Odom, CISCO Press.

**Web Resources :**

- 1) <https://learningnetwork.cisco.com>

Subject Code	Subject Name	Teaching Scheme (Contact Hours per Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
MCAL202	Lab-II: Data Structure(DS) & Web Application Development using Open Source Tools Lab	---	06	---	---	03	---	03
<b>Examination Scheme</b>								
<b>End Semester Exam [Once in a Semester]</b>								
Laboratory Name					Term Work	Practical	Oral	Total
MCAL202: Lab-II: Data Structure (DS) & Web Application Development using Open Source Tools Lab					25	50	25	100

**Pre-requisites:** Basic understanding of fundamentals of any programming language and web technology

#### Course Educational Objectives (CEO):

<b>CEO 1</b>	To study various linear and non-linear data structures.
<b>CEO 2</b>	To provide knowledge for developing web applications using AJAX framework and open source tools.
<b>CEO 3</b>	To conceptualize effective storage mechanism for data and accessing it through web applications.

#### Course Outcomes: At the end of the course student will be able to

<b>MCAL202.1</b>	Effectively select the data structure model to be used for the real world problem.
<b>MCAL202.2</b>	Develop web based applications using AJAX framework and open source tools.
<b>MCAL202.3</b>	Build web application with effective storage mechanism for data.

#### Syllabus

Sr. No.	Session	Detailed Contents	Hours
1.	Sorting	Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, Radix Sort	04
2.	Searching	Linear Search, Binary search	02
3.	Stacks	Array implementation, Linked List implementation, Evaluation of postfix expression	04

4.	<b>Queue</b>	Simple Queue, Linked List implementation of ordinary queue, Linked List implementation of circular queue, BFS, Linked List implementation of priority queue, Double ended queue	<b>08</b>
5.	<b>Linked lists</b>	Singly Linked Lists: Insert, Display, Delete, Search, Count, Reverse Circular Linked List: Insert, Display, Delete, Search, Count, Reverse Doubly Linked Lists : Insert, Display, Delete, Search, Count, Reverse	<b>08</b>
6.	<b>Binary search trees</b>	Insert, Recursive traversal: preorder, postorder, inorder, Search Largest Node, Smallest Node, Count number of nodes	<b>08</b>
7.	<b>Heap</b>	MinHeap: reheapUp, reheapDown, Delete, MaxHeap: reheapUp, reheapDown, Delete, HeapSort	<b>04</b>
8.	<b>Hashing</b>	Methods for Hashing: Direct, Subtraction. Modulo Division, Digit Extraction, Fold shift, Fold Boundary, Methods for Collision Resolution, Linear Probe	<b>04</b>
9.	<b>Graphs</b>	Represent a graph using the Adjacency Matrix, Find the shortest path in a graph using Warshall's Algorithm, Find the minimum spanning tree (using any method Kruskal's Algorithm or Prim's Algorithm)	<b>04</b>
10.	<b>AJAX Framework</b>	Making a Server Request, Loading HTML scriptlets from server, AJAX events, Making an AJAX Style File Upload.	<b>04</b>
11.	<b>JavaScript</b>	Client side scripting with JavaScript, variables, functions, conditions, Pop up boxes, Working with string, Numbers and arrays, Event handling in JavaScript, Working with forms elements, Validating form fields, Introduction to DOM	<b>06</b>
12.	<b>Web Application Development using Bootstrap</b>	Bootstrap - Introduction to Bootstrap, Bootstrap Grid System, Bootstrap Grid System - Advanced, Creating Layouts with Bootstrap, Bootstrap CSS - Understanding the CSS, CSS Customization / Skins, Responsive Web design with Bootstrap, Single Page Responsive site with Bootstrap, Bootstrap Plugins, Bootstrap Layout Components	<b>06</b>
13.	<b>Web Application Development using Joomla</b>	Joomla - Joomla fundamentals, Understanding the concept of Joomla Positions, Changing the layout structure by changing the module positio, Understanding Basic Joomla Template, Customizing Joomla Template, Building Custom Joomla Template, Linking CSS, Linking Javascript, Creating Custom Form, Changing the Form appearance using CSS	<b>06</b>
14.	<b>Mini Project</b>	A Mini – Project based on DS and WAD using an integrated approach.(Maximum Two students in a Group)	<b>10</b>

**Reference Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to ALGORITHMS”, PHI, India Second Edition.
2. Richard F Gilberg Behrouz A Forouzan , “Data Structure A Pseudocode Approach with C“.
3. Shaum’s Outlines Data Structure Seymour Lipschutz TMH
4. HTML 5, Black Book, dreamtech Press
5. Learning PHP, MySQL, JavaScript, CSS and HTML 5, Robin Nixon, O’Reilly publication
6. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill
7. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
8. Extending Bootstrap Christoffer Niska, Packt Publishing
9. Bootstrap-Jake Spurlock O’Reilly publication
10. Joomla Bible, 2<sup>nd</sup> Edition, Ric Shreves, Wiley-India
11. The Official Joomla! Book, 2<sup>nd</sup> Edition, (Joomla! Press), by [Jennifer Marriott](#), [Elin Waring](#)