

AC 6/6/2012
Item No. 4.77

UNIVERSITY OF MUMBAI



**Syllabus for the
M. C. A.
(Master of Computer Application)**

(As per Credit Based Semester and Grading System
with effect from the academic year 2012–2013)

**Program Structure for
Master of Computer Application (MCA)
Mumbai University
(With Effect from 2012-2013)
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	Computer Organization and Architecture	04	--	--	04	--	--	04		
MCA103	Software Engineering	04	--	--	04	--	--	04		
MCA104	Discrete Mathematics	04	--	--	04	--	--	04		
MCA105	Principals and Perspective of Management	04	--	--	04	--	--	04		
L101	Lab I – Programming and S.E. Lab	--	06	--	--	03	--	03		
L102	Lab II – Web Technology & Web Project Development Lab	--	06	--	--	03	--	03		
Total		20	12	--	20	06	--	26		
Subject Code	Subject Name	Examination Scheme								
		Theory Course					Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.					
		Test1	Test 2	Avg.						
MCA101	Object Oriented Programming	20	20	20	80	--	--	--	100	
MCA102	Computer Organization and Architecture	20	20	20	80	--	--	--	100	
MCA103	Software Engineering	20	20	20	80	--	--	--	100	
MCA104	Discrete	20	20	20	80	--	--	--	100	

	Mathematics								
MCA105	Principals and Perspective of Management	20	20	20	80	--	--	--	100
L101	Lab I – Programming and S.E. Lab	--	--	--	--	25	50	25	100
L102	Lab II – Web Technology & Web Project Development Lab	--	--	--	--	25	50	25	100
Total		100	100	100	400	50	100	50	700

**Program Structure for
Master of Computer Application (MCA)
Mumbai University
(With Effect from 2012-2013)**

Semester II

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned					
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total		
MCA201	Data Structure	04	--	--	04	--	--	04		
MCA202	Operating System	04	--	--	04	--	--	04		
MCA203	Computer Network	04	--	--	04	--	--	04		
MCA204	Probability and Statistics	04	--	--	04	--	--	04		
MCA205	Financial Accounting	04	--	--	04	--	--	04		
L201	Lab I – Programming and Statistical Lab	--	06	--	--	03	--	03		
L202	Lab II – Operating System and DCN Lab	--	06	--	--	03	--	03		
Total		20	12	--	20	06	--	26		
Subject Code	Subject Name	Examination Scheme								
		Theory Course					Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.					
		Test1	Test 2	Avg.						

MCA201	Data Structure	20	20	20	80	--	--	--	100
MCA202	Operating System	20	20	20	80	--	--	--	100
MCA203	Computer Network	20	20	20	80	--	--	--	100
MCA204	Probability and Statistics	20	20	20	80	--	--	--	100
MCA205	Financial Accounting	20	20	20	80	--	--	--	100
L201	Lab I – Programming and Statistical Lab	--	--	--	--	25	50	25	100
L202	Lab II – Operating System and DCN Lab	--	--	--	--	25	50	25	100
Total		100	100	100	400	50	100	50	700

SEMESTER I

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA101	Object Oriented Programming	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam.					
Test1	Test 2	Avg.	[Once in a semester]					
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	C++ Fundamentals: Data types, Operators, Preprocessor directives, Declarations, Input & Output, control structures, structures, functions and arrays.	4 Hrs
2	Functions: Concept of function in C++, function prototypes in C++, function with parameters, Returning values From Functions. Reference Arguments, Overloaded Function, Default Arguments. Returning By Reference.	3 Hrs
3	Object oriented programming, Object And Classes: -Characteristics of object oriented programming, Making sense of core object concepts (Encapsulation Abstraction, Polymorphism, Classes, Massages Association, Inheritance) Implementation of Class in C++, C++ Objects As Physical Object, C++ Object As Data Types, Constructor, Object As Function Arguments. The Default constructor, Copy Constructor, Returning Object From Function. Structures And Classes. Inline	8 Hrs

functions, static, virtual and friend function. Classes Objects And Memory Static Class Data. Const Data. Const And Classes.

- 4 **Arrays and String:** Arrays Fundamentals. Arrays as Class Member Data. Arrays Of Object. String. The Standard C++ String Class. *4 Hrs*
- 5 **Operator Overloading:** Overloading Unary Operators. Overloading. Binary Operators. Data Conversion. Pitfalls of Operators Overloading And Conversion. Keywords Explicit And Mutable *4 Hrs*
- 6 **Inheritance:** Concept of Inheritance, Derived Class And Base Class, Derived Class Constructors, Overriding Member Function, Class Hierarchies, Public And Private Inheritance, Levels Of Inheritance, Multiple Inheritance, Ambiguity In Multiple Inheritance, Aggregation: Classes Within Classes, Inheritance And program Development. *4 Hrs*
- 7 **Pointer.** Addresses And pointer, The Address-Of Operator “&”, Pointer And Arrays, Pointer And Function, Pointer And C- Types String, Memory Management: New And Delete operator, Pointers to Objects, Debugging pointers. *4Hrs*
- 8 **Virtual Function and Polymorphism** *4Hrs*
Virtual Function, Assignment And Copy Initialization, this Pointer, Dynamic Type Information.
- 9 **Streams and Files.** *5 Hrs*
Streams Classes. Stream Errors. Disk File I/O with Streams, File Pointers, Error Handling In File I/O, File I/O With Member Function, Overloading the Extraction And Insertion Operators, Memory As A Stream Object, Command line Arguments, and Printer Output.
- 10 **Templates And Exceptions** *2Hrs*
Function Templates, Class Templates Exceptions.
- 11 **The Standard Template Library** *3Hrs*
Introduction Algorithms, Sequence Containers, Iterators, Specialized Iterators, Associative Containers, Storing User- Defined Object, Function Objects.
- 12 **References :-**

1. Object Oriented Programming in-C++ By Robert Lafore Techmedia Publication
2. The Complete Reference C ++ - By Herbert Sehlidt Tata Megraw-hill publication
3. Object Oriented Programming in C++ Saurav Sahay Oxford University Press
4. Object Oriented Programming and C++ R. Rajaram New Age International Publishers 2nd
5. OOPS C++ Big C++ Cay Horstmann Wiley Publication
6. C++ How to Program, 8/E Paul Deitel & Harvey Deitel

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA102	Computer Organization and Architecture	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	DIGITAL LOGIC Number system Boolean Algebra, Logic Gates Combinational Circuits Implementation of Boolean Functions Algebraic Simplification Karnaugh maps Multiplexers / Demultiplexers Decoders / Encoders Adders :Half, Full Sequential Circuits Flip- Flops: S-R, J-K, D Registers: Parallel, Shift Counters: Ripple, Synchronous	6 hrs
2	THE COMPUTER SYSTEM Computer function and Interconnection Computer functions	12 hrs

Interconnection Structures
Bus Interconnection
Memory System Design
Memory hierarchy and SRAM
Advanced DRAM Organisation
Interleaved and Associative memory
Nonvolatile memory
RAID
Cache Memory
Cache memory Principles
Elements of Cache design
Improving Cache Performance
Input / Output
Programmed I/O
Interrupt-driven I/O
Direct Memory Access
I/O Channels and Processors

3 CENTRAL PROCESSING UNIT

12 hrs

Instruction Set: characteristics & functions
Machine Instruction characteristics
Type of Operands
Types of Operations
Instruction set : addressing modes & formats
Addressing
Instruction Formats
CPU structure and Function
Processor Organization
Register Organization
Instruction Cycle
Instruction Pipelining
Instruction Level Parallelism and Superscalar Processors
Superscalar versus super pipelined
Limitations
Instruction level parallelism and machine parallelism
Instruction issue policy
Register Renaming
Branch Prediction
Superscalar Execution
Superscalar Implementation
Example: 8086 and Pentium Processor

4 CONTROL UNIT

4 hrs

Control Unit Operation
Micro-operations
Control of the processor

Hardwired Implementation
Microprogrammed Control (Basic concepts)

5 MULTIPROCESSOR ORGANISATION

6 hrs

Multiprocessor organizations
UMA, NUMA NORMA, Distributed memory
Types of Parallel Processor Systems
Parallel organizations
Symmetric Multiprocessors
Organization
Interconnection networks
– single bus, crossbar, mesh, tree & ring network
Clusters
Cluster Configurations
Cluster Computer Architecture
Cloud computing

6 Case Study:

2 hrs

Processor Specification & Design

References Books:

1. Digital Computer Fundamentals, Bartee C. Thomas , McGraw-Hill International Edition
2. Computer Architecture by Nicholas Carter , Schaum's outlines, McGraw-Hill
3. Computer Organization by Hamacher C., Zaky S. McGraw Hill
4. Computer Organisation and Architecture: Stallings, W Prentice Hall of India, New Delhi
5. Computer Architecture, Behrooz Parhami, Oxford University Press
6. Digital Computer Fundamentals, Bartee C. Thomas , McGraw-Hill International Edition
7. Computer Fundamentals Architecture & Organization B. Ram New Age
8. Computer Organization I.S.R.D.group Tata Mc Graw Hill

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA103	Software Engineering	04	--	--	04	--	--	04
Examination Scheme								
Theory				Term Work	Pract.	Oral	Total	
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	Software Engineering: The evolving role of software What is Software engineering? Changing nature of software Software Myths.	4Hrs
2	Approaches to system development SDLC Different models their advantages and disadvantages <ul style="list-style-type: none"> ○ Waterfall approach ○ Iterative approach ○ Extreme programming ○ Rad model, JAD ○ Unified process ○ Evolutionary software process model <ul style="list-style-type: none"> ▪ Incremental model ▪ Spiral model Concurrent development model Agile Model	5 Hrs
3	Software Analysis and Design Activities of the analysis phase Fact finding methods <ul style="list-style-type: none"> ○ Review existing reports forms and procedure descriptions ○ Conduct interviews ○ Observe & document business processes ○ Build prototypes ○ Questionnaires ○ Conduct jad sessions 	8 Hrs

Validate the requirements

- Structured walkthroughs

Feasibility Analysis: Types of feasibilities, Cost- benefit analysis, Payback analysis, ROI analysis, cash flow analysis.

Requirement Engineering

Software engineering task

Requirement elicitation techniques

Software Requirements Specification (SRS)

Software requirements: functional and non- functional domain

Requirement characteristics and characterization

Requirement qualities, requirement specification, requirement traceability,

Requirement prioritization

4	Software Project Planning:	6 Hrs.
	Size Estimation	
	Cost Estimation	
	Models	
	COCOMO, COCOMO-II	
5	Software Scheduling and Tracking	6 Hrs.
	Relationship between people and Effort: Staffing Levci Estimation, Effect of schedule Change on Cost	
	Selecting Software Engineering Tasks: Degree of Rigor, Task set selector, Task Network	
	Schedules: Work breakdown Structure. Task Network/Activity Networks, Gantt Charts, PERT Charts, CPM	
6	Design phase activities	6 Hrs.
	Develop system flowchart	
	Structure chart	
	○ Transaction analysis	
	○ Transform analysis	
	Software design and documentation tools	
	Hipo chart	
	Warnier orr diagram	
	Designing databases	
	Entities	
	Relationships	
	Attributes	
	Normalization	
7	Software Quality	3 Hrs
	Software Quality Management Systems	
	Software Quality Assurance	
	Software reviews	
	Formal Technical Reviews	
	Overview of ISO 9001 , SEI Capability Maturity Model, Mc Calls Quality	

- Model
- 8 Software Reliability and Maintenance** **5 Hrs**
- Software Reliability
 - Reliability Metrics
 - Reliability Growth Modeling
 - Software Reverses Engineering
 - Software Maintenance Costs
 - Estimation of Maintenance Costs

References:

1. Software Engineering- A Practioner’s Approach”, Seventh Edition , Pressman R.S, Tata McGraw Hill Publication.
2. “ Software Engineering” : PankajJalote.
3. “Software Engineering Concepts”, Richard Fairley,Tata McGraw Hill Publication.
4. “Software Engineering – Principles and Practice”, Waman S. Jawadekar, Tata McGraw Hill Publication.
5. System Analysis and Design- Elias M. Awad
6. System Analysis and Design- in a changing world –John Satzinger, Robert Jackson, Stephen Burd

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA104	Discrete Mathematics	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	Mathematical logic Propositions and logical operations Conditional Statements Methods of Proof Mathematical Induction Mathematical Statements Logic and Problem Solving Normal Forms Theory of Inference of statement calculus and predicate calculus	9 Hrs
2	Relations	9 Hrs

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

3 Semigroups and Groups 7 Hrs

Semigroups, Monoids
Products and Quotients of Semigroups
Groups
Products and Quotients of Groups

4 Groups and Coding 4 Hrs

Coding of Binary Information and Error Detection
Decoding and Error Correction

5 Recurrence Relations 8 Hrs

Tower of Hanoi
Iterations
Homogenous linear equations with constant coefficients
Particular Solution, Total Solution, Generating function
Line in a plane in general position
Divide and Conquer Recurrence Relations (Fast Multiplication of Integers,
Fast matrix Multiplication)

6 Graphs 5 Hrs

Graph
Representation of Graph
Adjacency matrix, Adjacency list
Euler paths and Circuits
Hamiltonian Paths and Circuits

7 Language and Finite State Machines 3 Hrs

Languages
Finite-State Machines

References

1. Discrete Mathematical Structures for Computer S Science by Kolman B and Bushy R
2. Discrete Mathematical Structures with applications to Computer Science by Tremblay and Manohar
3. Discrete Mathematics by C L Liu

4. Discrete Mathematics by Rosen
5. Discrete Mathematics by Johnsonbaugh, 6th ed.

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA105	Principals and Perspective of Management	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	Nature and functions of management: importance of management, definition of management, management functions, development of management thought, contribution of F. W. Taylor, Henri Fayol, Elton Mayo, system contingency approaches to management	5 hrs
2	Planning : nature of planning, importance, forms, types of planning, steps in planning, making planning effective, planning skills, strategic planning in the Indian industry	5 hrs
3	Decision-making: meaning, types, steps in rational decision-making, environment of decision-making, common difficulties in decision-making	5 hrs
4	Organization & authority delegation and decentralization: meaning, process of organizing, span of management, principles of organizing, organization structure, authority, responsibility. Role and Importance of Control Process, Budgeting and Variance Analysis .	7 hrs
5	Motivation & Leadership: meaning and Maslow, Herzberg and Macgregor's theory of motivation, meaning of leadership, characteristics of leadership, approaches to leadership, theories of leadership	5 hrs
6	Staffing & training and development: importance and need for proper staffing, recruitment, selection, placement, induction, types of training programmes, methods and selection of training method, training practices in India.	5 hrs
7	Performance appraisal & compensation plan: purpose of appraisal, criteria of PA, PA methods, primary compensation, incentive compensation, pay-for-performance, non-monetary incentives.	5hrs

- 8 Marketing:** Understanding the concept of marketing, marketing mix, Product policy, New product development, Product life cycle, Channels of distribution, Marketing research. 5 hrs

Reference books:

1. Principles & Practice of Management : L.M.Prasad
2. Principles of management: P.C. Tripathi and P.N. Reddy 4th edition, TMH
3. Marketing Management , Rama Swamy, Nama Kumari
4. Essential of Management , Koontz O'Donnell
5. HR & Personnel Management , Ashwathappa

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
L101	Programming and S.E. Lab	--	06	--	--	03	--	03
	Programming Lab		04			02		
	S.E. Lab		02			01		
Examination Scheme								
End Sem. Exam. [Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total
L101	Programming and Project Development Lab				25	50	25	100
	Programming Lab				15	25	15	55
	S.E. Lab				10	15	10	35
	Journal/Documentation					10 (5+5)		10

Session **Contents** **Hrs**

C++ Programming Lab:

- | | | |
|-----------|---|--------------|
| 1 | Assignment based on control structures, structures, functions | 3 hr |
| 2 | Assignment based on Arrays and String | 3 hr |
| 3 | Assignment based on Operator Overloading, Object And Classes | 3 hr |
| 4 | Assignment based on Inheritance | 3 hr |
| 5 | Assignment based on Pointer | 3 hr |
| 6 | Assignment based on Virtual Function and Polymorphism | 3 hr |
| 7 | Assignment based on Streams and Files | 4 hr |
| 8 | Assignment based on Templates And Exceptions | 4 hr |
| 9 | Assignment based on The Standard Template Library | 4 hr |
| 10 | Mini project in C++ | 10 hr |

Software Engineering Lab:

- 1 Introduction to Software Engineering CASE tools.** **2 Hrs**
- 2 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**3 Hrs**
- 3 Working with**
 - Degree of Rigor, Task set selector, Task Network
 - Estimate the Man power effort required for a project.
 - Calculate size the project.**3 Hrs**
- 4 Managing Project Cost** **3 Hrs**
- 5 Solving examples using COCOMO and COCOMO II models** **3 Hrs**
- 6 Case studies on Quality Standards.** **3 Hrs**
- 7 Case Study of any sample Project using MS Project** **3 Hrs**

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
L102	Lab II – Web Technology & Web Project Development Lab	--	06	--	--	03	--	03
	Web Technology Lab		04			02		
	Web Project Development Lab		02			01		
Examination Scheme								
End Sem. Exam. [Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total

L102	Lab II – Web Technology & Web Project Development Lab	25	50	25	100
	Web Technology Lab	15	25	15	55
	Web Project Development Lab	10	15	10	35
	Journal/Documentation		10 (5+5)		10

Session	Contents	Hrs
1	<p>Introduction to the Web</p> <p>Web Browser, Web Server, XAMPP, Web Development Cycle</p> <p>Web publishing, Static Web contents, Dynamic Web contents</p> <p>Introduction to HTML</p> <p>HTML fundamentals, HTML Tags, Elements and Attributes</p> <p>Structure of HTML code, Lists</p> <p>Block Level tags</p> <p style="padding-left: 40px;">Block formatting, Heading, Paragraph, Comments,</p> <p style="padding-left: 40px;">Text alignments and Font size.</p> <p>Text Level tags</p> <p style="padding-left: 40px;">Bold Italic, Underlined, Strikethrough, Superscript, Subscript</p> <p>(Lab Assignment: Develop web pages based on above tags)</p>	6 hrs
2	<p>HTML</p> <p>Inserting graphics, Linking and Scaling images.</p> <p>Table, Frameset, Forms</p> <p>(Lab Assignment: Develop web pages based on above tags)</p>	6 hrs
3	<p>Cascading Style Sheets</p> <p>The usefulness of Style Sheets, Creating Style sheets, Classes and Pseudo Classes, CSS Tags</p> <p>(Lab Assignment: Develop small website based on above HTML tags & by using CSS)</p>	6 hrs
4	<p>PHP</p> <p>PHP Essentials, Installation and Configuration files</p> <p>Variables, constants, Operators, Control Structures,</p>	6 hrs

- (Lab Assignment: Develop small web application based on above Syllabus)
- 5 PHP 6 hrs**
Strings, Array
- (Lab Assignment: Develop small web application based on above Syllabus)
- 6 PHP 6 hrs**
Functions , Built-in PHP Function Libraries, Forms
- (Lab Assignment: Develop small web application based on above Syllabus)
- 7 PHP 6 hrs**
Data Validation, File Handling (Including and Requiring Files,
Reading and Writing Files, Allowing Users to Download Files)
- (Lab Assignment: Develop small web application based on above Syllabus)
- 8 MYSQL 6 hrs**
Introduction about Database, Data Types, DML, DDL, Aggregate functions
Data Time functions
- (Lab Assignment: Develop small web application based on above Syllabus)
- 9 PHP 6 hrs**
PHP ODBC, Sessions, Cookies, FTP, GET and POST data, HTTP Headers,
HTTP Authentication
- (Lab Assignment: Develop small web application based on above Syllabus)
- 10 PHP 6 hrs**
GET and POST data, HTTP Headers, HTTP Authentication
- (Lab Assignment: Develop small web application based on above Syllabus)

Reference Books:

1. Textbook of Web Design – Joel Sklar, Cengage Learning
2. HTML: The Complete Reference – Thomas A. Powel
3. Web Technologies – Uttam K. Roy, Oxford
4. Head First PHP and MySQL- O'Reilly Publication
5. PHP: The Complete Reference – Steven Holzner
6. PHP and MySQL Web Development (3rd Edition)- Luke Welling, Laura Thomson
7. Developing Web Applications, Ralph Moseley, WSEwiley
8. PHP for the Web: Visual QuickStart Guide, 4/e - Larry Ullman, Pearson

Education

9. PHP 6 and MySQL 5 for Dynamic Web Sites: Visual Quick Pro Guide, Larry Ullman, Pearson Education

SEMESTER II

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
MCA201	Data Structures	04	--	--	04	--	--	04	
Examination Scheme									
Theory				Term Work	Pract.	Oral	Total		
Internal Assessment			End Sem. Exam. [Once in a semester]						
Test1	Test 2	Avg.							
20	20	20	80		--	--	--	100	

Unit	Contents	Hrs
1	<p>Introductions</p> <p>Algorithm specification: Pseudo code conventions, Recursive Algorithms, Recursion Tree Method. Performance Analysis: Space Complexity, Time Complexity, Amortized complexity, Asymptotic Notations (Big O, Omega, Theta). Practical complexities, Performance measurement .</p> <p>Sorting Techniques: Bubble, Insertion, Selection, Shell, Radix, Quick.</p> <p>Searching Technique: Sequential Search & Binary Search.</p>	7 hrs
2	<p>Algorithms to implement Link list (create structure, insert, delete, sort, search), Doubly Link List(create structure , insert, delete, sort, search), Circular link list(create structure , insert, delete, sort, search). Multi link list: (Insertion & Deletion) Stack (PUSH , POP Delete), Queue(Add , Remove): Simple queue, Double ended queue, circular queue, Priority Queue.</p>	6 hrs
3	<p>Hash Function:</p> <p>Different Hashing Techniques, Address calculation Techniques, Common hashing functions, Collision resolution techniques: Linear probe, quadratic prob, Key Offset. Rehashing. Double hashing. Link list addressing.</p>	6 hrs
4	<p>Introduction to Trees :</p> <p>General trees, Binary Tree, Binary tree traversal (Pre Order, In order, Post Order) DFS & BFS traversal of binary tree, Conversion from Tree to binary tree.</p> <p>Expression Tree: Prefix, Infix , Post fix notations of expression tree, Algorithms to Convert from prefix to infix & post fix etc. Binary Search Tree algorithm to implement BST, AVL Trees: concept and problems. Algorithms to rotate AVL Tree. Binary Threaded Tree, Huffman Tree.</p>	8 hrs
5	<p>Heap: Heap Structure, Min heap , Max heap, Basic algorithms: Reheap up &</p>	4 hrs

Reheap down, Build Heap, Insertion and Deletion in Heap Tree.

- | | | |
|---|--|-------|
| 6 | Multi ways Trees:
B-Tree(Insert node, delete node, search node, split node), Traversal of B Tree.
Introduction to B* Tree.
Comparison between B & B* Tree | 4 hrs |
| 7 | Graphs: Terminology & Operations
Graph Traversals(DFS and BFS)
Graph Storage Structure(Adjacency Matrix, Adjacency list)
Cost Adjacency Matrix
Minimum spanning Tree(using Prims & Krushkal Algorithms) | 6 hrs |
| 8 | Divide and Conquer, Back Tracking Method.
Dynamic programming: All pair shortest Path, Single source Shortest Path
(Dijkstra, Warshell etc.) | 4 hrs |

References:

1. Data Structure A Pseudocode Approach with C “Richard F Gilberg
Behrouz A Forouzan
2. Shaum’s Outlines Data Structure Seymour Lipschutz TMH
3. Data Structures & Program Design in C “ Robert Kruse C L Tondo
Bruce Leung Pearson
4. Data Structure using C “ AM Tanenbaum , Y Langsam & MJ Augenstein
Prentice Hall”.
5. An Introduction to Structure with application “ Jean Paul Trembly and
Paul Sorenson”
6. Data Structure and Program Design in C “ RL Kruse, BP Leung & CL
Tondo Prentice Hall
7. Data Structure & Algorithm Analysis in C “ Weiss, Mark Allen Addison
Wesley

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
MCA202	Operating System	04	--	--	04	--	--	04	
Examination Scheme									
Theory				Term Work	Pract.	Oral	Total		
Internal Assessment			End Sem. Exam. [Once in a semester]						
Test1	Test 2	Avg.							
20	20	20	80		--	--	--	100	

Unit	Contents	Hrs
1	Introduction to System Software <ul style="list-style-type: none"> ➤ Overview of all system softwares :- <ul style="list-style-type: none"> - Compiler - Assembler - Linker - Loader - Operating system - I/O manager 	3 hrs
2	Fundamentals of Operating System:- <ul style="list-style-type: none"> ➤ OS services and Components ➤ Multitasking , Multiprogramming, Multiprocessing ➤ Time Sharing ➤ Buffering ➤ Spooling ➤ Distributed OS 	3 hrs
3	Process and Thread Management <ul style="list-style-type: none"> ➤ Concept of process and threads ➤ Process states ➤ Process management ➤ Context switching ➤ Interaction between processes and OS ➤ Multithreading ➤ Example OS : Linux 	5 hrs
4	Concurrency Control <ul style="list-style-type: none"> ➤ Concurrency and Race Conditions ➤ Mutual exclusion requirements ➤ Software and hardware solutions ➤ Semaphores ➤ Monitors 	7 hrs

- Classical IPC problems and solutions
- Deadlock
 - Characterization
 - Detection
 - Recovery
 - Avoidance and Prevention

5 Memory Management

7 hrs

- Memory partitioning
- Swapping
- Paging
- Segmentation
- Virtual memory
 - Overlays
 - Demand paging
 - Performance of Demand paging
 - Virtual memory concepts
- Page replacement algorithms
- Allocation algorithms
- Example OS : Linux

6 I/O Systems

4 hrs

- 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 File systems

5 hrs

- File concept
- File support
- Access methods
- Allocation methods
- Directory systems
- File protection
- Free space management
- Example OS : Linux

8 Protection & Security

3 hrs

- 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
- Example OS: Linux

9 Case Study

3 hrs

- Android OS

Reference Books

1. Operating System Concepts (7th 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, Nabendu Chaki, Sarmishtha Neogy, Pearson
5. Operating Systems Design & Implementation Andrew S. Tanenbam, Albert S. Woodhull Pearson
6. Operating Systems Achyut S. Godbole Tata Mc Graw Hill
7. Operating Systems D.M.Dhardhere Tata Mc Graw Hill

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA203	Computer Networks	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit

Contents

Hrs

- | | | |
|---|---|-------|
| 1 | Introduction to digital communication, signal propagation, signal types, signal parameters, channel effects on transmission –attenuation, effects of limited bandwidth, delay distortion, noise, data rate limits-Nyquist’s theorem and Shannon’s | 4 hrs |
|---|---|-------|

theorem

- | | | |
|---|---|-------|
| 2 | Basics of computer Network, topology & types of topologies, types of networks(LAN, MAN, WAN), types of communications(Asynchronous and synchronous) , modes of communications(simplex, half duplex, full duplex), protocols and standards | 3 hrs |
| 3 | Networking models, Design issues of the layer, ISO-OSI Reference Model, Internet Model (TCP/IP), Comparison of ISO-OSI & TCP/IP Model

Connectivity Devices : Passive & Active Hubs, Repeaters, , Switches (2-Layer Switch, 3-Layer Switch(Router)), Bridges (Transparent Bridges, Spanning Tree, Bridges, Source Routing Bridges) , Gateways | 4 hrs |
| 4 | Concept of Intranet & Extranet, Internet Information Server(IIS), Principles of Application Layer Protocols, The Web and HTTP, FTP, Electronic Mail in the Internet , DNS: The Internet's Directory Service. | 7 hrs |
| 5 | Transport-Layer Services, port addressing, Multiplexing and Demultiplexing, Principles of Reliable Data Transfer, Congestion Control, TCP's Congestion Control. Quality of Service : Introduction, Application, Queue Analysis: M/M/1 as a packet processing Model, QoS Mechanisms Queue management Algorithms, Feedback, Resource, reservation; Queued data and Packet switched traffic modeling. Application and QoS. | 8 hrs |
| 6 | Network Service Model, IP addressing and subnetting, Routing Principles, Hierarchical Routing, the Internet Protocol, Router's internal features, Routing Algorithms.,classfull and classless addressing
Routing in the Internet: Intra and interdomain routing; Unicast Routing Protocols : RIP, OSPF, BGP; Multicast Routing Protocols : MOSPF, DVMRP. Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes. IP over ATM, Multi protocol Label switching (MPLS), Storage Area Network (SAN). | 8 hrs |
| 7 | Data Link Layer, Error Detection and Correction Techniques, Multiple Access Protocols, LAN Addresses and ARP, PPP: The Point-to-Point Protocol , Ethernet standards – IEEE 802.3, 802.4, 802.5, 802.11, | 8 hrs |
| 8 | Physical Layer, types of media(wired and wireless media, study of wired and wireless media) | 4 hrs |

References:

1. Kurose, J.F. and Ross K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", Third Edition, 2005, Addison-Wesley.
2. An Engineering Approach to Computer Networking, S. Keshav, Addison-Wesley.
3. Forouzan B A., "Data Communication and Networking", Third Edition, 2004, McGraw Hill. Andrew Tenenbaum, Computer Networks, PHI

4. TCP/IP Protocol Suite, (B. A. Forouzan), Tata McGraw Hill edition, Third Edition.
5. Computer Networks: Principles, Technologies and Protocols for Network design, (N. Olifer, V. Olifer), Wiley India Edition (1 st Edition).
6. TCP/IP Volume 1, 2, 3, (W. Richard Stevens), Addison Wesley.
7. TCP/IP Volume I and II, (D. E. Comer), Pearson Education.
8. Unix Network Programming (W. R. Stevens), Vol. 1, Pearson Education.
9. High Performance Communication Networks, (J. Walrand, P. Varaiya), Morgan Kaufmann

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA204	Probability and Statistics	04	--	--	04	--	--	04
Examination Scheme								
Theory				Term Work	Pract.	Oral	Total	
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80	--	--	--	100	

Unit

Contents

Hrs

STATISTICS:

- | | | |
|----------|---|--------------|
| 1 | Frequency Distribution and Measures of Central Tendency
Continuous Frequency Distribution
Histogram
Frequency Polygon
Mean, Median, Mode | 3 Hrs |
| 2 | Measures of Dispersion
Range
Quartile Deviation
Mean Deviation
Standard Deviation
Coefficient of Variation | 4 Hrs |
| 3 | Skewness and Kurtosis
Karl Pearson's coefficient of Skewness
Bowley's coefficient of Skewness
Kurtosis | 3 Hrs |
| 4 | Correlation and Regression
Regression lines
Coefficients of regression
Karl Pearson's coefficient of correlation
Spearman's rank correlation coefficient | 5 hrs |
| 5 | Testing of Hypothesis | 8 hrs |

Means and proportions – Hypothesis concerning one and Two means. Type I and Type II errors. One tail, two-tail tests.
Tests of significance – Student's t-test, F- test, Chi-Square test.
Analysis of Variance – One way and two-way analysis

PROBABILITY:

- | | |
|---|--------------|
| 6 Probability | 6 Hrs |
| Random experiment, sample space, events, axiomatic Probability, Algebra of events, Conditional Probability, Multiplication theorem of Probability, Independent events, System reliability, Baye's Theorem | |
| 7 Random variables | 4 Hrs |
| Discrete random variable
Continuous random variable
Two-dimensional random variable
Joint probability distribution
Stochastic independence | |
| 8 Mathematical Expectation | 3 Hrs |
| Properties of expectation, properties of variance, Covariance | |
| 9 Probability Distributions of Discrete Random Variable | 5 hrs |
| Bernoulli, Binomial, Poisson, Geometric distribution | |
| 10 Probability Distributions of Continuous Random Variable | 5 hrs |
| Normal, Uniform, Exponential, Gamma, Beta distribution | |

References :

1. Introduction to Probability & Statistics J.Susan Milton, Jesse C. Arnold Tata McGraw Hill
2. Probability and its computer applications : Kishore Trivedi, PHI
3. Schaum's Outlines Probability, Random Variables & Random Process Tata McGraw Hill
4. Fundamental of Mathematical Statistics – S.C.Gupta, V.K.Kapoor

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
MCA205	Financial Accounting	04	--	--	04	--	--	04
Examination Scheme								
Theory					Term Work	Pract.	Oral	Total
Internal Assessment			End Sem. Exam. [Once in a semester]					
Test1	Test 2	Avg.						
20	20	20	80		--	--	--	100

Unit	Contents	Hrs
1	Financial Accounting: Nature and scope, Limitations of Financial Accounting. (ii) Basic Concepts and Conventions. Accounting Standards: Meaning, Procedure for issue of Accounting Standards in India, Significance, Generally Accepted Accounting Principles (GAAP). (iii) Accounting Process: Journal, Ledger and Cash Book	12 hrs (Theory + Numerical)
2	i) Final Accounts of a Sole-Trader and Partnership Firms	12 hrs (Theory + Numerical)
3	i) Cash Flow Statements: Meaning, Usefulness, Preparation of a cash flow statement in accordance with Accounting Standard 3(Revised) issued by the Institute of Chartered Accountants of India. (only indirect method), Limitations of cash flow statement. (only theory) ii) Cash Budget (Theory + Numerical)	9 hrs (only theory)
4	Financial Statements Analysis: Meaning and objectives, Techniques of Analysis, Ratio Analysis: Advantages, significance and limitations - Liquidity Ratios: Current Ratio, Acid Test Ratio. Solvency Ratios: Debt-equity Ratio, Capital gearing Ratio, Interest Coverage Ratio, proprietary ratio. Profitability Ratios related to sales: Gross profit Ratio, Net Profit Ratio, Operating profit ratio, Profitability Ratios related to investments: Return on total assets (ROTA), Return on investment (ROI), Return on equity (ROE), Return on equity share holders fund, EPS, DPS and Price – earning ratio. Activity Ratios: Stock turnover Ratio and Debtors turnover Ratio.	9 hrs (Theory + Numerical)

References

1. Book Keeping & Accountancy by L.N.Chopde and D.H. Choudhari
2. Financial Management by Kishorilal S. N. Maheshwari, Financial Accounting, 4th edition, Vikas Publication, New Delhi.
3. Dr. IM Pandey, Essentials of Financial Management, 3rd edition, Vikas
4. Dr. S.N. Maheshwari, A text book of -Accounting for management, 2nd edition, Vikas
5. P.C. Tulsian, Financial Accounting, Tata McGraw Hill, New Delhi.
6. "Financial Management" Text and Problems : M.Y.Khan, P.K.Jain

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
L201	Lab I – Data Structures and Statistics Lab	--	06	--	--	03	--	03
	Data Structures Lab		04			02		
	Statistics Lab		02			01		
Examination Scheme								
End Sem. Exam. [Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total
L201	Programming and Project Development Lab				25	50	25	100
	Data Structures Lab				15	25	15	55
	Statistics Lab				10	15	10	35
	Journal/Documentation					10 (5+5)		10

Session	Title	Hrs
	Data Structures Lab:	
1	Assignment in sorting Techniques Bubble, Insertion, Selection, Shell, Quick, Radix	3 hrs
	Searching Techniques Sequential search Binary Search	
2	Implementation of Stack(using Array & Link list).	3 hrs
3	Implement all the different types of queues(eg: Queue, Doubly Ended Queue, Circular Queue etc.)	3 hrs
4	A menu driven program that implements singly linked list for the following operations. Create, Display, count, merge, union, intersection Reverse, Sort, Append,	3 hrs
5	a menu driven program that implements doubly linked list for the following	3 hrs

Operations.

Create , Display , Count , Insert , Delete , Search , Copy
Reverse , Sort , Append,

- 6** A menu driven program that implements Singly circular linked list for the following operations.
Create , Display , Count , Insert , Delete , Search , Copy, Reverse , Sort **3 hrs**
- 7** A menu driven program
- a. Create a Binary search tree
 - b. Traverse the tree in Inorder, Preorder and Post order
 - c. Search the tree for a given node and delete the node
- 8** A menu driven program that implements Heap tree (Maximum and Minimum Heap tree)for the following operations. (Using Array) Insert , Delete **4 hrs**
- 9** A program to implement double hashing technique to map given key to the address space. Also write code for collision resolution (linear probing) **4 hrs**
- 10** Implementation of Shortest path Algorithm for a given directed graph & undirected graph. **4 hrs**
- 11** Implementation of insert and delete nodes in a graph using adjacency matrix **4 hrs**
- 12** Implementation of Graph Traversal and minimum spanning Tree. **3 hrs**

Statistics Lab:

- 1** Introduction to the software (Environment, Entering data and formatting , handling data files, performing calculations, handling utilities, formulae and functions) **2 Hrs**
- 2** Visualizing (Handling different types of data variables, Creating tables, frequency distribution tables and presenting the data (Charts, Diagrams, graphs, polygons and plots) **2 Hrs**
- 3** Data Descriptors (Measure of Central Tendencies, Dispersions), correlation, regression) **3 Hrs**
- 4** Probability Distributions **2 Hrs**
- 5** Sampling Distributions and Estimation **2 Hrs**

6	Linear Correlation Analysis Linear Regression Analysis	3 Hrs
7	Hypothesis Testing	3 Hrs
8	ANOVA	3 Hrs

Students will perform the practicals using advanced excel or C or XL miner or SPSS

Subject Code	Subject Name	Teaching Scheme (Contact Hours per week)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
L202	Lab II – Operating System Lab and Networking Lab	--	06	--	--	03	--	03
	Operating System Lab		04			02		
	Networking Lab		02			01		
Examination Scheme								
End Sem. Exam. [Once in a semester]								
Laboratory Name					Term Work	Pract.	Oral	Total
L202	Lab II – Operating System Lab and Networking Lab				25	50	25	100
	Operating System Lab				15	25	15	55
	Networking Lab				10	15	10	35
	Journal/Documentation					10 (5+5)		10

Session	Contents	Hrs
Operating System Lab		
1	Linux System (PROGRAMMING LAB) Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell.	9 hr
2	Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces. 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	9 hr

commands, kill, ps, who, sleep, Printing commands, grape, fgrep, find, sort, Cal, banner, touch, file, file related commands-ws, sat, cut, grep, dd, etc. Mathematical commands- bc, expr, factor, units. vi, joe, vim editor

- 3 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, awk programming **9 hr**
- 4 Study of gcc **4 hr**
- 5 Linux installation demo **3 hr**
- 6 Samba server configuration (Linux +Windows access) **6 hr**

Reference Books (for LAB)

1. Unix – Sumitaba Das
2. Unix Shell Programming – Yashwant Kanetkar, BPB Publications
3. Linux Programming A Begineer's Guide – Richard Petersen

Networking Lab - Practical's to be done Packet Tracer (or other simulating software)

- 1 Study of Packet Tracer software interface **1 hr**
- 2 Basic Configuration of router **1 hr**
- 3 Assigning ipv4 & ipv6 addresses to the interfaces of the routers **1 hr**
- 4 Configure VLANs on the router, Spanning tree **3 hr**
- 5 Configuration of PPP **3 hr**
- 6 Configure RIPv2, Configure EIGRP **3 hr**
- 7 Configure OSPF **3 hr**
- 8 Access List Configuration, Configuration of NAT **3 hr**
- 9 Configuration of DCHP, Configuration of switch **3 hr**