Guru Nanak Dev Engineering College, Ludhiana

(An Autonomous College u/s 2(f) and 12(B) of UGC Act 1956)

(Affiliated to I.K. Gujral Punjab Technical University, Jalandhar)

Scheme and Syllabus of Master of Computer Applications (MCA)

Batch 2020 Onwards

By
Board of Study
Department of Computer Applications

PROGRAM OUTCOMES (POs)

Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

Problem Analysis: Identify, formulate, research literature, and solve complex computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

Design /Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

Conduct investigations of complex Computing problems: User search-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

Project management: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.

Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

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

Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Guru Nanak Dev Engineering College, Ludhiana

Scheme and syllabus of MCA

Batch 2020 Onwards

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA101	Core Theory	Information Management	4	0	0	40	60	100	4
PGCA102	Core Theory	Programming Languages	4	0	0	40	60	100	4
PGCA103	Core Theory	Advanced Database Management System	4	0	0	40	60	100	4
PGCA104	Core Theory	Mathematical Foundations of Computer Science	4	0	0	40	60	100	4
PGCA105	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	40	60	100	3
PGCA106	Core Practical/Laboratory	Information Management Laboratory	0	0	4	60	40	100	2
PGCA107	Core Practical/Laboratory	Programming Languages Laboratory	0	0	4	60	40	100	2
PGCA108	Core Practical/Laboratory	Advanced Database Management System Laboratory	0	0	4	60	40	100	2
	TOTAL		**19**	**0**	**12**	**380**	**420**	**800**	**25**

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA201	Core Theory	Advanced Operating System	4	0	0	40	60	100	4
PGCA202	Core Theory	Programming in Python	4	0	0	40	60	100	4
PGCA203	Core Theory	Advanced Software Engineering	4	0	0	40	60	100	4
PGCA204	Core Theory	Data Communication and Networks	4	0	0	40	60	100	4
PGCA205	Core Theory	Advanced Data Structures	4	0	0	40	60	100	4
PGCA206	Core Practical/Laboratory	Advanced Operating System Laboratory	0	0	4	60	40	100	2
PGCA207	Core Practical/Laboratory	Programming in Python Laboratory	0	0	4	60	40	100	2
	TOTAL		**20**	**0**	**8**	**320**	**380**	**700**	**24**

Students will undergo 4 weeks Summer Training after 2nd semester. Couse Code: PGCA-B1

Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA301	Core Theory	Advanced Java	4	0	0	40	60	100	4
PGCA302	Core Theory	Web Technologies	4	0	0	40	60	100	4
PGCA303	Core Theory	E-Commerce	4	0	0	40	60	100	4
PGCAxxx	Elective Theory	Elective-1	4	0	0	40	60	100	4
PGCA304	Core Practical/Laboratory	Minor Project	0	0	4	100	-	100	4
PGCA305	Core Practical/Laboratory	Advanced Java Laboratory	0	0	4	60	40	100	2
PGCA306	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	60	40	100	2
	TOTAL		**16**	**0**	**12**	**380**	**320**	**700**	**24**

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA401	Core Theory	Interactive Computer Graphics	4	0	0	40	60	100	4
PGCA402	Core Theory	Object Oriented Analysis & design with UML	4	0	0	40	60	100	4
PGCA403	Core Theory	Cyber Laws and IPR	4	0	0	40	60	100	4
PGCAxxx	Elective Theory	Elective-II	4	0	0	40	60	100	4
PGCA404	Core Practical/Laboratory	Major Project	0	0	4	40	60	100	4
PGCA405	Core Practical/Laboratory	Interactive Computer Graphics Laboratory	0	0	4	60	40	100	2
PGCA406	Core Practical/Laboratory	Object Oriented Analysis & design with UML Laboratory	0	0	4	60	40	100	2
	TOTAL		**16**	**0**	**12**	**320**	**380**	**700**	**24**

List of Elective-I

Course Code	Course Title
PGCA307	System Programming
PGCA308	Data Warehousing & Mining
PGCA309	Theory of Computation

List of Elective-II

Course Code	Course Title
PGCA407	Cloud Computing
PGCA408	Network Security & Administration
PGCA409	Big Data Analytics

First Semester

Course Code: PGCA 101

Course Name: Information Management

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course outcomes

CO1: Design, document and develop robust, extensible and highly maintainable data-intensive applications using cutting edge technologies tailored to the specific needs of any business scenario.
CO2: Explain the core aspects of information technology for their implementation in a business.
CO3: Understand and facilitate the strategic and operational benefits of business models and technology applications.
CO4: Apply the information management principles and tools to manage a business.
CO5: Acquire knowledge about various Information Systems.

Section-A

Introduction to Information Technology - Definition, Applications in various sectors, Different types of software, Generations of Computers, Input and output Devices, Various storage devices like HDD, Optical Disks, Flash Drives. Different Types of data file formats: Types and Applications. [10]

Section-B

IT Infrastructure in India – Telecommunication, Internet research and Broadband
Data Collection and Data Management, Data Models, Information vs. Knowledge, Various techniques to derive information, Information Management [12]

Section-C

Management Information System – Definition, Strategic Management of Information, Decision Making, Development Process of MIS, Strategic Design of MIS, Business Process Reengineering, Understanding Knowledge Management, Designing a Knowledge Management System, Nature and Scope of Business Intelligence, Information Security-Meaning and Importance, Organizational Security Policy and Planning, Access Control and Operations Security [14]

Section-D

Office Automation (Word processing, Spreadsheet, Presentation, E-Mail Clients),
Content Management System and Architecture [8]

Suggested Books:

1. **Introduction to Information Technology, Second Edition,** *Turban, Rainer, Potter,* WSE, Wiley India.
2. **Data Warehousing Fundamentals: A Comprehensive Study For IT Professionals,** *Paulraj Ponnian BWSTN,* Wiley India.
3. **Information Assurance For The Enterprise: A Roadmap To Information Security**- *Corey Schou, Daniel Shoemaker,* Mc-Graw Hill Publications.
4. **Management Information System: Text and Cases,** *Waman Jawadekar,* Mc-Graw Hill Publications.

Course Code: PGCA 102
Course Name: Programming Languages

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course outcomes

CO1: Prepare object-oriented design for small/medium scale problems.

CO2: Demonstrate the differences between traditional imperative design and object-oriented design.

CO3: Explain class structures as fundamental, modular building blocks.

CO4: Understand the role of inheritance, polymorphism structures in building code.

CO5: Acquire knowledge of using classes written by other programmers when constructing their systems.

Section-A

Evolution to Programming languages, various generations of Programming Languages, Introduction to Algorithm, procedure to solve a logical and numerical problem, Algorithm Representation using flow chart and , Introduction to C and C++, data types, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence, Conditional branching and Loops, Identifier and keywords, constants, C++ operators, type conversion, Variable declaration, statements, expressions, conditional expression loop statements, breaking control statements. [14]

Section-B

Defining function, types of functions, storage class specifiers, recursion, pre-processor, header files and standard functions, Arrays, pointer arithmetic's, structures, pointers and structures, unions, bit fields typed, enumerations, Passing array as an argument to function. [10]

Section-C

Classes, member functions, objects, arrays of class objects, nested classes, constructors, destructors, friend functions, dynamic memory allocation, Inheritance, single inheritance, types of base classes, types of derivations, multiple inheritance, container classes, member access control, Function overloading, operator overloading, polymorphism, early binding, polymorphism with pointers, virtual functions, virtual destructors, late binding, pure virtual functions, Exception Handling, [14]

Section-D

Introduction to open source languages: features, advantages, disadvantages and their Comparison [6]

Suggested Readings / Books:

1. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia Publications, 1994.
2. Programming in Ansi C , E.Balagurusamy, Tata McGraw Hill.
3. Object Oriented Programming with C++, E.Balagurusamy, Tata McGraw Hill.
4. Object Oriented Software Engineering, S.Halladay and M. Wiebel, BPB Publications, 1995.

Course Code: PGCA 103

Course Name: Advanced Database Management Systems

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course outcomes

CO1: Express the basic concepts of DBMS and RDBMS.
CO2: Apply normalization theory to the normalization of a database
CO3: Apply the concept of Transaction Management & Recovery techniques in RDBMS.
CO4: Analyze various advanced databases prevailing in market, Big Data, Temporal Databases, Parallel and Distributed Databases, XML Database and multidimensional Databases
CO5: Demonstrate No SQL databases (Open Source)

Section – A

Introduction to DBMS: Basic DBMS terminology; Architecture of a DBMS: Data Independence - Physical and Logical Independence, Degree of Data Abstraction, Initial Study of the Database, Database Design, Implementation and Loading, Testing and Evaluation, Operation, Maintenance and Evaluation.

Conceptual Model:

Entity Relationship Model, Importance of ERD, Symbols (Entity: Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality). [12]

Section – B

Database Models and Normalization: Comparison of Network, Hierarchical and Relational Models, Object Oriented Database, Object Relational Database, Comparison of OOD & ORD; Normalization and its various forms, De- Normalization, Functional Dependencies, Multi-valued Dependencies, Database Integrity: Domain, Entity, Referential Integrity Constraints.

Transaction Management and Concurrency Control: Client/ Server Architecture and implementation issues, Transaction: Properties, Transaction Management with SQL, Concurrency; Concurrency Control: Locking Methods: (Lock Granularity, Lock Types, Two Phase Locking, Deadlocks), Time Stamping Method, Optimistic Method, Database Recovery Management. [14]

Section – C

Distributed Databases: Centralized Verses Decentralized Design; Distributed Database Management Systems (DDBMS): Advantage and Disadvantages; Characteristics, Distributed Database Structure, Components, Distributed Database Design, Homogeneous and Heterogeneous DBMS. [8]

Section – D

Business Intelligence and Decision Support System:
The need for Data Analysis, Business Intelligence, Operational Data vs. Decision Support Data, DSS Database properties and importance, DSS Database Requirements.

OLAP and Database Administration:
Introduction to Online Analytical Processing (OLAP), OLAP Architecture Relational, Star Schemas, Database Security, Database administration tools, Developing a Data Administration Strategy. [10]

Suggested Books:

1. Data Base Systems, Peter Rob Carlos Coronel, Cengage Learning, 8th ed.
2. Database System Concepts, Henry F. korth, Abraham, McGraw-Hill, 4th ed.
3. An Introduction to Database Systems, C.J.Date, Pearson Education, 8th ed.
4. Principles of Database Systems, Ullman, Galgotia Publication, 3rd ed.
5. An Introduction to Database Systems, Bipin C. Desai, Galgotia Publication

Course Code: PGCA 104

Course Name: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course outcomes

CO1: Demonstrate a solid foundation in mathematics which exhibits both breadth and depth of knowledge.
CO2: Understand the role of mathematics in Computer Applications.
CO3: Apply the operations of simple and multi graphs, directed and undirected graphs, Eulerian and Hamiltonian Graphs, Shortest path algorithms

CO4: Apply Algebra of logic, Propositions, Tautologies and contradiction, Equivalence and implication, Principle of Mathematical induction
CO5: Determine if a given graph is simple or a multi graph, directed or undirected, Eulerian and Hamiltonian Graphs, Shortest path algorithm and determine the connectivity of a graph.

Section A
A general introduction, simple and multi graphs, directed and undirected graphs, Eulerian and Hamiltonian Graphs, Shortest path algorithms, Chromatic number, Bipartite graph, graph coloring. [12]
Section B
Sets and Relations: Definition of sets, subsets, complement of a set, universal set, intersection and union of sets, De-Morgan's laws, Cartesian products, Equivalent sets, Countable and uncountable sets, minset, Partitions of sets, Relations: Basic definitions, graphs of relations, properties of relations [12]
Section C
Algebra of logic, Propositions, Connectives, Tautologies and contradiction, Equivalence and implication, Principle of Mathematical induction, quantifiers [10]
Section D
Introduction of a Matrix, its different kinds, matrix addition and scalar multiplication, multiplication of matrices, transpose etc. Square matrices, inverse and rank of a square matrix, solving simultaneous equations using Gauss elimination, Gauss Jordan Methods, Matrix Inversion method [10]

Suggested Books:
1. Alan Doerr, Applied Discrete Structures for Computer Science, Galgotia Publications.
2. Kolman and Busby, Discrete Mathematical structures for Computer Sciences, PHI.

Course Code: PGCA 105
Course Name: Technical Communication

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 3
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Ability Enhancement Course
Total marks: 100	

Course outcomes
CO1: The objective of the course is to help the students become the independent users of English language.
CO2: Students will acquire basic proficiency in reading & listening, comprehension, writing and

speaking skills.
CO3: Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO4: They will be able to converse fluently.
CO5: They will be able to produce on their own clear and coherent texts.

Section-A

Basics of Technical Communication- Functions of Communication-Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7 C's and other principles), Non-verbal Communication. [12]

Section-B

Basic Technical Writing: Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters – Format & various types. [8]

Section-C

Advanced Technical Writing: Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, and Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography. [12]

Section-D

Verbal Communication- Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. Technical Communication- MS-Word, Adobe Frame maker and ROBO Help [12]

Suggested Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi
2. KK Ramchandran, et al Business Communication, Macmillan, New Delhi
3. Swati Samantaray, Busines Commnication and Commnicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD)

Course Code: PGCA 106

Course Name: Information Management Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course outcomes

CO1: Design data-intensive applications using cutting edge technologies tailored to the specific needs of any business scenario.
CO2: Implement the core aspects of information technology in a business.
CO3: Understand the strategic and operational benefits of business models and technology applications.
CO4: Create the information management principles and tools to manage a business.
CO5: Develop the knowledge for various Information Systems.

List of Experiments

1. Familiarization with the Computer System:
   a) To explain the part of the computer system such as system unit, input devices, output devices connected to the computer.
   b) To explore the outside view of the system unit that includes the panels on front and ports at the rear.
   c) To explore the inside view of the system unit that includes the motherboard, processor, expansion slots, various add-on cards, storage devices, power supply, fans.
   d) To understand the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use.
   e) To introduce the graphical user interface (desktop) of Windows operating system to explain the various elements of the desktop such as taskbar, icons (My Computer, Recycle Bin, etc.), short cuts, notification area to configure the desktop that include selecting the wall paper, selecting the screen saver with or without password protection, selecting the screen resolution and color quality.
2. Navigating with Window Explorer:
   a) To navigate with the drives.
   b) To create new folders.
   c) To move folders from one drive to another drive.
   d) To search files and folders.
   e) To view and/or change the attributes of the files and folders.
3. Exploring the Internet:
   a) To understand the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc.
   b) To create email-account, sending mails, receiving mails, sending files as attachments, etc.

c) To login to a remote computer
d) To search information using search engines

4. Microsoft Word:
   a) To familiarize with parts of Word window
   b) To create and save a document To set page settings, create headers and footers
   c) To edit a document and resave it To use copy, cut and paste features
   d) To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.
   e) To use spelling and grammar checking feature
   f) To preview print a document
   g) To create a table with specified rows and columns
   h) To enter data in a table To select a table, a row, a column or a cell
   i) To inset new row and/or a column
   j) To delete a row and/or a column
   k) To split and merge a row, column or a cell
5. Microsoft Excel:
   a) To familiarize with parts of Excel window
   b) To create and save a workbook with single and/or multiple worksheets
   c) To edit and format text as well numbers
   d) To apply operations on range of cells using built-in formulae
   e) To preview and print a worksheet
   f) To insert new row and/or column in a worksheet To delete a row and/or column in a worksheet
   g) To create a variety of charts
   h) To import and export data to or from worksheet
6. Microsoft PowerPoint:
   a) To familiarize with parts of PowerPoint window
   b) To create and save a new presentation
   c) To apply design templates to a presentation
   d) To insert, edit and delete a slide
   e) To use different views of slides
   f) To use slide show from beginning or from the current slide
   g) To preview and print a presentation
   h) To check spellings in a presentation
   i) To add clip art and pictures in a slide
   j) To add chart, diagram and table in a slide
   k) To set animation for a selected slide and/or for entire presentation
   l) To create slide master and title master
   m) To create a custom show

Course Code: PGCA 107
Course Name: Programming Languages Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -

Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes:

1. Compare and contrast programming paradigm with procedure oriented programming paradigm.
2. Design and implement efficient programs to solve computing problems in a high level programming language.
3. Utilize knowledge of different object oriented principles to identify and apply the appropriate techniques in problem solving.
4. Apply the knowledge acquired to troubleshoot programming related problems.
5. Utilize the knowledge and principles of programming while working in multidisciplinary teams.

[Control statements]

1. Demonstrate the use of conditional control statements like if, if-else, if-else ladder, nested ifelse, and switch-case statement.
2. Illustrate the use of loop control statements like for, while, and do-while.
3. Write a program to demonstrate the use of break and continue statement. [Arrays and Strings]
4. Demonstrate the use of one dimensional and two dimensional arrays by using suitable programs.
5. Illustrate the use of various string handling functions.

[Classes and Objects]

6. Program to illustrate the concept of classes and object.
7. Program to illustrate the concept of nesting of member functions.
8. Program to show the working of static members (static functions and static variables) in a class.
9. Program to demonstrate the use of friend functions.

[Constructors and Destructors]

10. Program to illustrate the concept of default constructor, parameterized constructor, and copy constructor.
11. Program to illustrate the concept of destructors.

[Polymorphism]

12. Program to demonstrate the concept of operator overloading
13. Program to illustrate the concept of function overloading and constructor overloading.
14. Program to illustrate the concept of virtual functions and pure virtual functions.

[Inheritance]

15. Program to illustrate the concept of inheritance.
16. Program to illustrate the concept of ambiguity in multiple inheritance.
17. Program to illustrate the order of execution of constructors and destructors in inheritance.
18. Program to demonstrate the concept of function overriding.

[Exception handling]

19. Program to illustrate the exception handling mechanism.

Course Code: PGCA 108

Course Name: Advanced Database Management Systems Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes

1. Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
2. Design different views of tables for different users and to apply embedded and nested queries.
3. Design and implement a database for a given problem according to well-known design principles that balance data retrieval performance with data consistency.
4. Demonstrate and understand relational algebra in Database which is helpful to design related database software components.
5. Identify the user requirements from a typical business situation, and to document them.

List of Experiments

Perform demonstration in PL/SQL on:

1. Comparative study of various Database Management Systems
2. Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL)
3. How to apply Constraints at various levels.
4. View data in the required form using Operators, Functions and Joins.
5. Creating different types of Views for tailored presentation of data
6. How to apply Conditional Controls in PL/SQL
7. Error Handling using Internal Exceptions and External Exceptions
8. Using various types of Cursors
9. How to run Stored Procedures and Functions
10. Creating Packages and applying Triggers
11. Creating Arrays and Nested Tables.

Second Semester

Course Code: PGCA 201

Course Name: Advanced Operating Systems

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Understand the basics of operating systems like kernel, shell, types and views of operating systems.
CO2: Describe the various CPU scheduling algorithms and remove deadlocks.
CO3: Explain various memory management techniques and concept of thrashing
CO4: Use disk management and disk scheduling algorithms for better utilization of external memory.
CO5: Recognize file system interface, protection and security mechanisms.

Section A

Multi-Processor and Distributed Operating System: Introduction, Architecture, Organization, Resource sharing, Load Balancing, Availability and Fault Tolerance, Design and Development Challenges, Inter-process Communication, Distributed Applications – Logical Clock, Mutual Exclusion, Distributed File System. [14]

Section B

Real Time and Embedded Operating Systems: Introduction, Hardware Elements, Structure - Interrupt Driven, Nano kernel, Microkernel and Monolithic kernel based models. Scheduling - Periodic, Aperiodic and Sporadic Tasks, Introduction to Energy Aware CPU Scheduling [12]

Section C

Cluster and Grid Computing: Introduction to Cluster Computing and MOSIX OS, Introduction to the Grid, Grid Architecture, Computing Platforms: Operating Systems and Network Interfaces, Grid Monitoring and Scheduling, Performance Analysis, Case Studies [10]

Section D

Cloud Computing: Introduction to Cloud, Cloud Building Blocks, Cloud as IaaS, PaaS and SaaS, Hardware & Software Virtualization, Virtualization of OS – Hypervisor KVM, SAN & NAS back-end concepts.

Mobile Computing: Introduction, Design Principals, Structure, Platform and Features of Mobile Operating Systems (Android, IOS, Windows Mobile OS) [8]

References:

1. Sibsankar Haldar, Alex A. Arvind, —Operating Systems, Pearson Education Inc.
2. Tanenbaum and Van Steen, —Distributed Systems: Principles and Paradigms, Pearson, 2007.
3. M. L. Liu, —Distributed Computing: Principles and Applications, Addison-Wesley, Pearson

4. Maozhen Li, Mark Baker, —The Grid - Core Technologies, John Wiley & Sons, 2005

Course Code: PGCA 202
Course Name: Programming in Python

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Familiar with Python environment, data types, operators used in Python.
CO2: Compare and contrast Python with other programming languages.
CO3: Learn the use of control structures and numerous native data types with their Methods.
CO4: Design user defined functions, modules, and packages and exception handling Methods.
CO5: Create and handle files in Python and learn Object Oriented Programming Concepts.

Section - A

Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.
Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. [12]

Section - B

Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.
Control Structures: Decision making statements, Python loops, Python control statements.
Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations) [12]

Section - C

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.
Python Modules: Module definition, Need of modules, creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.
Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. [12]

Section - D

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects. [8]

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: PGCA 203

Course Name: Advanced Software Engineering

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.

CO2: Able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project.

CO3: Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.

CO4: Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.

CO5: Able to use modern engineering tools necessary for software project management, time management and software reuse.

Section-A

Software Engineering: The software problem, Evolution of Software Engineering, Principles of software engineering, Software Development vs. Software Engineering.

Software Process: Software Process, Selection of appropriate process model, Software Process

Models- Waterfall, Spiral, Prototyping, Agile Methodology- Scrum and XP. [12]

Section-B

Advanced Requirement Analysis & Design: Analysis Principles, SRS, Requirement Elicitation Techniques- FAST and QFD, Design Principles, Design Concepts, Data Design, Architectural Design-Architectural Styles, Procedural Design [10]

Section-C

Software Project Management: The Management Spectrum, Software Project Planning and its characteristics, Types of metrics, Effort Estimation- FP, LOC, FP vs. LOC, Schedule & Cost Estimation Models- Activity Networks- PERT/CPM, COCOMO-I, COCOMO-II, Risk Assessment- Probability Matrix, Risk Management.

Software Testing: Testing Fundamentals- Error/Fault/Failure, Testing Principles, Test Cases, Testing Techniques-White Box & Black Box, Unit Testing, Integration Testing, System Testing, Verification and Validation Testing, Acceptance Testing. [14]

Section-D

Software Quality Management: S/W Quality, Importance of S/W Quality, Quality Metrics, Quality Standards- ISO 9126, Change Control, Change Control Process.

Advanced S/W Engineering: CASE Tools, Reverse Engineering, Re-engineering, Web Engineering. [8]

References:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (6th ed.), McGraw- Hill, 2006
2. P. Jalote, An Integrated Approach to Software Engineering(3rd ed.), Narosa Publishing House, 2005
3. K.K. Aggarwal and Y. Singh, Software Engineering (revised 2nd ed.), New Age International Publishers, 2006 .
4. Sommerville, Ian, Software Engineering, Addison-Wesley Publishing Company, (2006) 8th ed.
5. Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing Company Ltd., New Delhi (2006) 3rd ed.

Course Code: PGCA 204

Course Name: Data Communication and Networks

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Understand basic computer network technology.
CO2: Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
CO3: Describe data link protocols, multi-channel access protocols and IEEE 802 standards for LAN.

CO4: Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme.
CO5: Discuss the elements and protocols of transport layer

SECTION-A

Introduction to Data Communication: Components of Data Communication, Data representation, Transmission Impairments, Switching, Modulation, Multiplexing.
Review of Network Hardware: LAN, MAN, WAN, Wireless networks, Internetworks.
Review of Network Software: Layer, Protocols, Interfaces and Services.
Review of Reference Models: OSI, TCP/IP and their comparison.
Physical Layer Transmission Media: Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (Radio, Microwave, Infrared), Introduction to ATM, ISDN, Cellular Radio and Communication Satellites [12]

SECTION-B

Data Link Layer: Services provided by DLL: framing, error control, flow control, medium access
Medium Access Sub layer: Channel Allocation, MAC protocols – ALOHA, CSMA protocols, Collision free protocols, Limited Contention Protocols, Wireless LAN protocols, IEEE 802.3, 802.4, 802.5 standards and their comparison [10]

SECTION-C

Network Layer: Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector, Hierarchical, Broadcast, Multicast). Congestion Control Algorithms (Leaky bucket, Token bucket, Load shedding), Internetworking, IP Protocol, ARP, RARP
Network Trouble Shooting: Using Ping, Traceroute, IPconfig, Netstat, nslookup [14]

SECTION-D

Transport Layer: Addressing, Establishing and Releasing Connection, Flow Control, Buffering, Internet Transport Protocol (TCP and UDP)
Application Layer: Domain name system, E-mail, File transfer protocol, HTTP, HTTPS, World Wide Web. [8]

Suggested Books: -

1. Tanenbaum, Andrew S., 2009: Computer Networks(4thEdition),PHI.
2. Forouzan, B. A., 2009: Data Communications and Networking, Fourth Edition, Tata McGrawHill.
3. DouglasE.Comer, 2004: Internetworking with TCP/IP (Vol.1, 4th Edition), CPE.
4. Stallings,William 2008: Data and Computer Communications(8thEdition), PHI.
5. Nance, Bary, 1997: Introduction to Networking, PHI, 4th Edition.

Course Code: PGCA 205

Course Name: Advanced Data Structures

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs

External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Choose appropriate data structures and algorithms and use it to design solution for a specific problem.
CO2: Execute the operations of hashing to retrieve data from data structure.
CO3: Comprehend and select algorithm design approaches in a problem specific manner.
CO4: Design and analyze programming problem statements.
CO5: Come up with analysis of efficiency and proofs of correctness.

Section-A

Introduction to Data Structure: Concept of data, problem analysis, data structures and data structure operations, notations, mathematical notation and functions, algorithmic complexity, Big-O Notation and time space trade off. Overview of Arrays, Recursion, Pointers, Pointer Arithmetic, Array of pointers, Arrays in terms of pointers, Static and Dynamic Memory Management, Garbage Collection, Understanding and Implementation of various Data Structures with applications, Stack: operations like push, pop and various applications like conversion from infix to postfix and prefix expressions, evaluation of postfix expression using stacks, Queues: operations like enqueue, dequeue on simple, circular and priority queues. Linked Lists: operations like creations, insertion, deletion, retrieval and traversal on single, circular and doubly linked list [14]

Section-B

Trees definitions and concepts: Root, Node, Leaf Node, Level, Degree, Height and Tree representation using Linked List and Array Types of Trees: Binary trees, Binary search tree, Height balanced (AVL) tree, B- trees, B+ Tree Tree operations: creation, insertion, deletion and traversals (Preorder, In-order, Post- ordered) and searching on various types of trees [10]

Section-C

Heap: Definition, Structure, Algorithms and applications, Graph definitions and concepts: Edge, Vertices, and Graph representation using Adjacency matrix, Adjacency lists, Types of graphs: Weighted, Unweighted, Directed, Undirected Graphs, Graph operations: creation, insertion, deletion, traversals and searching (depth-first, breadth-first) of various types of graphs and Dijkstra's algorithm for shortest distance calculation. [12]

Section-D

Searching: Concept and efficiency of linear and binary search algorithms, Sorting: Concepts, Order, Stability, Efficiency of various algorithms (Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort), Hashing: Definition, Implementation and applications [8]

Suggested Books:

1. Data Structures ,A Pseudo code Approach with C++ - Gilberg and Forouzan by Cengage Hill
2. Schaum's Outline of Data Structures with C++ - Hubbard John. R by Tata McGraw-
3. Data Structures Using C and C++ - Langsam, Augenstein, Tanenbaum by Pearson Education

Course Code: PGCA 206

Course Name: Advanced Operating System Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes:

CO1: Analyze the services, architectures and principles used in the design of modern operating systems.
CO2: Execute Linux commands for files and directories, creating and viewing files, File comparisons and Disk related commands.
CO3: Utilize the concept of virtualization for creating a virtual machine and installing operating system on virtual machine.
CO4: Demonstrate shell programming by using shell variables and shell keywords for automated system tasks.
CO5: Identify the key characteristics of multiple approaches used for the design and development of the operating system.

List of Experiments:

1. Installation process of various Operating Systems.
2. Virtualization, Installation of virtual machine software and installation of Operating System on virtual machine.
3. Execute various basic Linux commands, commands for files and directories, creating and viewing files, File comparisons, Disk related commands.
4. Execute Linux commands for processes in Linux, connecting processes with pipes, background processes, managing multiple processes.
5. Study and usage of vi Editor.
6. Basics of Shell programming, various types of shell, Shell Programming in bash.
7. Study and implementation of shell variables, shell keywords.
8. Implement conditional statements, looping statement and case statement in Shell programming.
9. Implement parameter passing and arguments in Shell programming.
10. Implement Shell programs for automate system tasks and report printing.

Course Code: PGCA 207

Course Name: Programming in Python Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 4

Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes:

CO1: Understand the concept of data structures, python and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.
CO2: Implement linear and non-linear data structures for processing of ordered or unordered data.
CO3: Analyze various algorithms based on their time and space complexity.
CO4: Implement various control structures and numerous native data types.
CO5: Design user defined functions, modules, and packages and exception handling Methods.

LIST OF EXPERIMENTS	
1	Write a Python program to create an array of 5 elements and display the array items. Access each individual element through indexes.
2	Write a Python program to reverse the order of the items in the array.
3	Write a Python program to append a new item to the end of the array.
4	Write a Python program to remove a specified item using the index from an array.
5	Write a Python program to get the length of an array.
6	Write a Python program for binary search.
7	Write a Python program for sequential or linear search.
8	Write a Python program to sort a list of elements using the bubble sort algorithm.
9	Write a Python program to sort a list of elements using the selection sort algorithm.
10	Write a Python program to sort a list of elements using the insertion sort algorithm.
11	Write a Python program to sort a list of elements using the quick sort algorithm.
12	Write a Python program to create a singly linked list, append some items and iterate through the list.
13	Write a Python program to find the size of a singly linked list.
14	Write a Python program to search a specific item in a singly linked list and return true if the item is found otherwise return false.
15	Write a Python program to delete the first item from a singly linked list.
16	Write a Python program to create circular single linked lists.
17	Write Python programs to implement stack and its operations using list.
18	Write Python programs to implement queue and its operations using list.
19	Write a Python program to create a Balanced Binary Search Tree (BST) using an array (given) elements where array elements are sorted in ascending order.

20	Write a Python program to find the kth smallest element in a given a binary search tree.
21	Write a Python program to traverse the binary tree using pre-order, post-order and in-order traversals.
22	Write a Python program to count the number of nodes in binary search tree.
23	Write a Python program to traverse the graph using Depth First Search and Breadth First Search
24	Write a Python program to create Red Black Tree and perform operations of Insertion and Deletion in it.
25	Write a Python program to implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

Third Semester

Course Code: PGCA 301

Course Name: Advanced Java

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Develop solutions for a range of problems using object-oriented programming.
CO2: Apply divide and conquer strategy to searching and sorting problems using iterative and/or recursive solutions.
CO3: Design and implement simple GUI applications.
CO4: Develop structured programmes for various tasks of moderate complexity and requirements.
CO5: Demonstrate improvement in efficiency of programs using good programming techniques

Section A

Introduction: Object Oriented Concept overview, features and applications of Java, Differences between Java and C++, structure of Java Program, understanding class path. Building Blocks: Literals, Tokens, Keywords, constants, variables & Data types, scope of variables, Operators, Expressions, Flow Control statements, Arrays, Vectors, Type Conversion, Command Line Arguments, Review of classes and methods, Access specifiers, constructors, Inheritance, static Classes, Abstract Classes, Final Classes, Wrapper Classes: Autoboxing and Unboxing, Garbage Collection & Finalize method, Enumerated types and annotations, Handling String and String Buffer classes, Method Overloading and Overriding, Nesting of methods and methods with varargs [14]

Section B

Interfaces & Packages: Interfaces and implementing multiple inheritances through interfaces, Packages, Multithreaded Programming, Synchronization.

Exception Handling: Introduction, Handling System defined Exceptions, Creating and handling user defined exception.

Managing I/O: Introduction to streams, Handling and using various Stream Classes, Random, String Tokenizer, and Scanner classes [12]

Section C

Applet and Graphic Programming: Introduction to applets, Types of applets, Using Applet Applications, Passing Parameters to applets, Introduction to Graphic Programming: Applying 2-D transformations on Objects, Event Handling, Layouts, Frames, Panels, Menu's, Pop-up Menus. [10]

Section D

Advanced Programming: Servlet Programming (Servlet Life Cycle, Generic Servlet, HttpServlet, HttpServletRequest, HttpServletResponse [8]

REFERENCES: -
1. Introduction to Java Programming, Comprehensive Version, Y. Daniel Liang, Pearson, 9/E
2. Java 2 The Complete Referenceb by Petric Noughton And Herbet Schildt, McGraw Hill Professional, 1999
3. Head First java by Kethy Seirra and Bert Bates, Oxford Publications.
4. Head First Sevlets and JSP, 2_{nd} Edition by Bryan Basham, Kathy Sierra, Bert Bates, O'Rielly Media.

Course Code: PGCA 302

Course Name: Web Technologies

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Understand, analyze and apply the role of languages like HTML, DHTML, CSS, XML, Javascript, VBScript, ASP, PHP and protocols in the workings of the web and web applications
CO2: Analyze a web project and identify its elements and attributes in comparison to traditional projects.
CO3: Create web pages using HTML, DHTML and Cascading Styles sheets.
CO4: Analyze and build interactive web applications using ASP and ASP.NET.
CO5: Build web applications using PHP, XML documents and XML Schema, and consume web services.

SECTION- A

Introduction to XML, XML Basics, XML Syntax and Editors, Elements, Attributes, Document Type Definitions (DTD), XML Schemas (XSD), XML Namespaces, XML Document Object Model, XSLT, Use of XSLT with XML. [10]

SECTION- B

Introduction to Ajax, Use of Ajax in Website, Introduction to J-Query, Overview, retrieving page content, manipulating page content, working with events [12]

SECTION- C

Introduction to Web Services, Use of Web Services, Types of Web Services, Introduction to SOAP, Syntax of SOAP, Envelope, Header and Body, Introduction to JSON, Syntax and Use. [12]

SECTION- D

Introduction to Content Management System CMS(Types, Usages, Benefits),Introduction to Word press- Use, Building a simple website using Word press, Study of Word press dashboard, Customization of Word press website, Creation of Network Websites. [10]

TEXT BOOKS:

1. Professional XML, Wrox Publications.
2. Web Services Essentials: Distributed Applications with XML-RPC, SOAP,
3. Web Services Essentials: Distributed Applications with XML-RPC, SOAP,UDDI & WSDL By Ethan Cerami, O'Reilly

Course Code: PGCA 303

Course Name: E-Commerce

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Demonstrate an understanding of the foundations and importance of E-commerce
CO2: Demonstrate an understanding of retailing in E-commerce by analyzing branding and pricing strategies, using and determining the effectiveness of market research and assessing the effects of disintermediation.
CO3: Analyze the impact of E-commerce on business models and strategy.
CO4: Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational
CO5: Discuss legal issues and privacy in E-Commerce.

Section–A

Introduction to Electronic Commerce, Potential benefits & limitations of E-Commerce, Traditional Commerce vs. E-Commerce vs M-Commerce, Different E-Commerce Models (B2B, B2C, C2C, P2P), E-Commerce applications, Social Networks, Auctions & Portals, Legal and Ethical issues in E-Commerce, E-commerce trends and prospects, E-commerce and taxation, Legal aspects of e-commerce [12]

Section–B

Introduction to Electronic Data Interchange, Types of EDI, Benefits of EDI. Overview of Electronic Payment system, Types of Electronic payment schemes (Credit cards, Debit cards, Smart cards, Internet banking), Issues in Electronic payment systems, Web Based Marketing and Communications: Online Advertising, E-Mail Marketing, Online Catalogs, Social Marketing and Targeted Marketing, Techniques and Strategies [12]

Section–C

WWW concepts, Client/Server Computing, Web Servers and Clients, Web Browsers, Protocols and Ports, IP Address, Domains & DNS, URL[10]

Section – D

Factors in E-Commerce Website design, Web and Database integration, Website Optimization strategies, E-Commerce security, threats, managing security issues through internet security

protocols and standards, and Firewall. [10]

REFERENCES:-

1. E-Commerce Essentials by Kenneth Laudon and Carol Traver – Pearson Publication
2. Frontiers of Electronic Commerce by Ravi Kalakota, Andrew B.Whinston - Addison Wesley Publication
3. E-Commerce, Fundamentals and Applications by Henry Chan, Raymond Lee, Tharam Dillon and Elizabeth Chang - Wiley India Publication
4. Web Enabled Commercial Application Development Using HTML, ,JavaScript, DHTML and PHP by Ivan Bayross BPB Publication

Course Code: PGCA 307

Course Name: System Programming

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective - I
Total marks: 100	

Course Outcomes

CO1: Familiarity with basic UNIX OS concepts such as: process, program, process groups, signals, running programs, process control, address space, user and kernel modes, system calls, and context switching.
CO2: Acquire knowledge in file I/O (i.e. open, close, read, write, seek).
CO3: Familiar of using sockets to implement client-server environment.
CO4: Familiar in using thread execution models.
CO5: Understand to handle signals and exceptions within a process and to control processes.

Section-A

Assemblers and Macro Processors: Language processors, data structures for language processing, General Design Procedure, Single pass and two pass assembler and their algorithms, assembly language specifications (example MASM). Macro Instructions, Features of Macro Facility: Macro instruction arguments, Conditional macro expansion, Macro calls within macro. [10]

Section-B

Loaders and Linkers & Editors: Loader Schemes: Compile and go loader, general loader scheme, absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Relocation, Design of Absolute Loader, Bootstrap Loaders, Dynamic Linking, MS-DOS Linker, Text Editors, Line Editor, Steam Editors, Screen editor, Word processors, Structure editors. [12]

Section-C

Compiler Design: Introduction to various translators, interpreters, debuggers, various phases of compiler, Introduction to Grammars and finite automata, Bootstrapping for compilers, Lexical Analysis and syntax analysis, Intermediate Code Generation, Code optimization techniques, Code generation, Introduction to YACC, Just-in-time compilers, Platform Independent systems. [14]

Section-D

Operating System: Operating Systems and its functions, Types of operating systems: Real-time OS, Distributed OS, Mobile OS, Network OS, Booting techniques and subroutines, I/O programming, Introduction to Device Drivers, USB and Plug and Play systems, Systems Programming (API's). [8]

TEXT BOOKS:

• Donovan J.J., Systems Programming , New York, Mc-Graw Hill, 1972.
• Leland L. Beck, System Software, San Diego State University, Pearson Education, 1997.
• Dhamdhere, D.M., System Programming and Operating Systems, Tata Mc-Graw Hill 1996.

REFERENCES:

1. Aho A.V. and J.D. Ullman Principles of compiler Design Addison Wesley/ Narosa 1985.

Course Code: PGCA 308

Course Name: Data Warehousing and Data Mining

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective - I
Total marks: 100	

Course Outcomes

CO1: Design a data mart or data warehouse for any organization
CO2: Develop skills to write queries using DMQL
CO3: Extract knowledge using data mining techniques
CO4: Adapt to new data mining tools
CO5: Explore recent trends in data mining such as web mining, spatial-temporal mining

Section A

Review of Data Warehouse: Need for data warehouse, Big data, Data Pre-Processing, Three tier architecture; MDDM and its schemas, Introduction to Spatial Data warehouse, Architecture of Spatial Systems, Spatial: Objects, data types, reference systems; Topological Relationships, Conceptual Models for Spatial Data, Implementation Models for Spatial Data, Spatial Levels, Hierarchies and Measures Spatial Fact Relationships. [12]

Section B

Introduction to temporal Data warehouse: General Concepts, Temporality Data Types, Synchronization and Relationships, Temporal Extension of the Multi Dimensional Model, Temporal Support for Levels, Temporal Hierarchies, Fact Relationships, Measures, Conceptual Models for Temporal Data Warehouses : Logical Representation and Temporal Granularity [12]

Section C

Introduction to Data Mining functionalities, Mining different kind of data, Pattern/Context based Data Mining, Bayesian Classification: Bayes theorem, Bayesian belief networks

Naive Bayesian classification, Introduction to classification by Back propagation and its algorithm, Other classification methods: k-Nearest Neighbor, case based reasoning, Genetic algorithms, rough set approach, Fuzzy set approach [12]

Section D

Introduction to prediction: linear and multiple regression, Clustering: types of data in cluster analysis: interval scaled variables, Binary variables, Nominal, ordinal, and Ratio-scaled variables; Major Clustering Methods: Partitioning Methods: K-Mean and K-Mediods, Hierarichal methods: Agglomerative, Density based methods: DBSCAN [8]

References:

1. Data Mining: Concepts and Techniques By J.Han and M. Kamber

Publisher Morgan Kaufmann Publishers

2. Advanced Data warehouse Design (from conventional to spatial and temporal applications) by Elzbieta Malinowski and Esteban Zimányi

Publisher Springer

3. Modern Data Warehousing, Mining and Visualization By George M Marakas, Publisher Pearson

Course Code: PGCA 309

Course Name: Theory of Computation

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective - I
Total marks: 100	

Course Outcomes

CO1: Understand the basic concepts of formal languages, automata and grammar types, as well as the use of formal languages and reduction in normal forms.

CO2: Demonstrate the relation between regular expressions, automata, languages and grammar with formal mathematical methods.

CO3: Design push down automata, cellular automata and Turing machines performing tasks of moderate Complexity.

CO4: Analyse the syntax and formal properties, parsing of various grammars such as LL(k) and LR(k).

CO5: Describe the rewriting systems and derivation languages.

Section-A

1. Introduction, Sets , Logic , Functions , Relations , Languages , Proofs Mathematical Induction , Strong Principle of Mathematical Induction , Recursive Definitions ,Structural Induction

2. Regular Languages & Regular Expressions, Finite Automata (FA), Distinguishing Strings w.r.t. Language , Union, Intersection, & Compliment of Languages [10]

Section-B

3. Non-deterministic Finite Automata (NFA), NFA with Null-Transitions, Kleene's Theorem

4. A Criterion for Regularity, Minimal Finite Automata, Pumping Lemma for Regular Languages

5. Introduction to Context-Free Grammar (CFG) , Regular Grammars , Derivation (Parse) Trees & Ambiguities , An Unambiguous CFG for Algebraic Expressions , Simplified Forms & Chomsky Normal Forms [12]

Section-C

6. Introduction to Push Down Automata (PDA), Deterministic PDA (DPDA), PDA corresponding to a Given CFG , CFG Corresponding to a Given PDA , Parsing

7. The Pumping Lemma for CFG , Intersection & Complement of CFGs , Decision Problems Involving CFGs [14]

Section-D

8. Turing Machine (TM) Definition & Examples, Computing a Partial Function with a TM

9. Recursive Enumerable & Recursive Languages, Enumerating a Language, Context-Sensitive Languages & Chomsky Hierarchy [8]

Reference Book:

"Introduction to Languages and the Theory of Computation", John C. Martin, Tata McGraw-Hill, (2003), 3rd Edition, ISBN: 007049939X

Suggested Additional Reading:

1. "Elements of the Theory of Computation", Harry Lewis & Christos H. Papadimitriou,IEEE (PHI), 2nd Edition ,ISBN-978-81-203-2233-2.
2. " Theory of Computation¦, Michael Sipser, ", Cengage Learning(2007), ISBN-13: 978-81-315- 0513-7
3. Introduction to Automata Theory, Languages, and Computation ¦, Hopcroft, Motwani & Ullman, Pearson Education, 3rd Edition, (2008), ISBN: 978-81-317-2047-9

Course Code: PGCA 304
Course Name: Minor Project

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 100	**Duration of end semester exam (ESE):** 3hrs
External max. marks: NIL	**Elective status:** Core
Total marks: 100	

To provide the hands on experience in analyzing, designing and implementing various projects, students are assigned minor projects based on the languages they have learned so far. Based on the project work a project report should be prepared under the guidance of faculty and submitted to department for evaluation.

Course Code: PGCA 305
Course Name: Advanced Java Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes:

CO1: Apply the knowledge of JAVA language syntax and semantics to write and execute Java programs.
CO2: Analyze the different aspects of a specific problem and design Java programs based on object oriented principles like classes, objects, constructors and inheritance.

CO3: Using the concept of applets and event handling develop GUI interfaces for a computer program to interact with users and to implement the event based GUI handling principles.

CO4: Identify various erroneous conditions in the system and implement the merits of exception handling techniques to make the system bug free.

CO5: Design Java programs to design a system to meet industrial needs and to solve real world problems based on client-server communication.

List of Experiments:

1. Implementation of basic Java programs.
2. Implementation of control structures.

3. Implementation of classes and objects.
4. Using constructors and overloaded methods.
5. Reading and writing Console Input / Output.
6. Implementing Inheritance concepts.
7. Implementation of Packages and Interfaces.
8. Using Exception handling mechanism.
9. Implementation of multithreading concepts.
10. Implementation of Applets.

Course Code: PGCA 306

Course Name: Web Technologies Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Develop XML files using concept of XML DOM, XSLT and XML Namespaces.

CO2: Implement programs to validate the XML Documents with respect to given XML schemas and DTD.

CO3: Develop an interactive website using jQuery or AJAX.

CO4: Develop solution to complex problems using appropriate web services and content management software.

CO5: Develop pages using suitable client side and server side web technologies.

CO6: Design and develop websites using word press software.

List of Experiments

1. Installation of Apache Tomcat Server.
2. Design an XML document to store information about a student in an engineering college. The information must include URN, Name, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
3. Write an XML file which will display the Book information. It includes the following:
   1) Title of the book
   2) Author Name
   3) ISBN number

4) Publisher name

5) Edition

6) Price

Write a Document Type Definition (DTD) to validate the above XML file.

4. Display the XML file created in previous program as:

The contents should be displayed in a table. The header of the table should be in color GREY. And the Author names column should be displayed in one color and should be capitalized and in bold. Use your own colors for remaining columns.

Use XML schemas XSL and CSS for the above purpose.

5. Create a script to retrieve data from a TXT file using XMLHttpRequest.
6. Create a script to retrieve data from an XML file and display the data in an HTML table.
7. Develop a script using jQuery to solve the following:

a) Limit character input in the text area including count.

b) Based on check box, disable/enable the form submit button.

8. Develop a script using jQuery to solve the following:

a) Fade in and fade out all division elements.

b) Animate an element, by changing its height and width.

9. Create a script to send some request to a SOAP Server over HTTP.
10. Create your own website using word press software.

Fourth Semester

Course Code: PGCA 401

Course Name: Interactive Computer Graphics

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Demonstrate an understanding of contemporary graphics hardware.
CO2: Create interactive graphics applications in C++ using one or more graphics application programming interfaces.
CO3: Functions to implement graphics primitives.
CO4: Demonstrate geometrical transformations.
CO5: Demonstrate an understanding of the use of object hierarchy in graphics applications.

SECTION A

Review of Computer Graphics, Applications of computer graphics. Introduction to Graphic devices like light pens, Graphic tablets, Graphic Cards, Data Glove, Digitizers, Graphs and types of Graphs. Cathode -Ray tube, Raster Scan displays, Random Scan displays, Architecture of a Raster and Random Graphics System with display processor, Color generating techniques (shadow mask, beam penetration) , 3-D viewing devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Workstations, Color Models (RGB and CMY), color lookup Table. [12]

SECTION B

Input and Output primitives, Process and need of Scan Conversion, Scan conversion algorithms for line, circle and ellipse, effect of scan conversion, Bresenham's algorithms for line and circle along with their derivations, midpoint circle algorithm with derivation , area filling techniques, flood fill techniques, character generation techniques (like typography, vector and bitmap).

2-Dimensional Graphics: Cartesian and Homogeneous Co-ordinate System, Geometric transformations (translation, Scaling, Rotation, Reflection, Shearing), Composite transformations, affine transformation, Two dimensional viewing transformation and windowing and clipping (line, polygon and text). Concave and Convex Polygon, Cohen Sutherland line clipping and its algorithm, Sutherland Hodgeman polygon clipping. [14]

SECTION C

3-dimensional Graphics: Geometric transformations (translation, Scaling, Rotation, Reflection, Shearing), Composite transformations, Parallel and Perspective Projections. Bezier curves and its properties, B-Spline curves. Fractals, Classification of fractals. [8]

SECTION D

Hidden line and surface elimination algorithms: Z-buffer, Painters algorithm, scan-line, sub-division, Shading and Reflection: Diffuse reflection, Specular reflection, refracted light, Halftoning, Dithering

techniques. Surface Rendering Methods: Constant Intensity method, Gouraud Shading, Phong Shading (Mash Band effect). Morphing of objects [10]

References:

1. D. Hearn and M.P. Baker, —Computer Graphics¦, PHI New Delhi; Third Edition.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes,. R.L Phillips, ¦Computer Graphics Principles & Practices, Second Edition¦, Pearson Education, 2007.
3. R.A. Plastock and G. Kalley, —Computer Graphics¦, McGraw Hill, 1986.
4. F.S. Hill: Computer Graphics using Open GL- Second Edition, Pearson Education-2003.

Course Code: PGCA 402

Course Name: Object Oriented Analysis and Design using UML

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Understand the fundamental principles of OO programming.

CO2: Master key principles in OO analysis, design, and development.

CO3: Familiar to the application of the Unified Modeling Language (UML) towards analysis and design.

CO4: Master common patterns in OO design and implement them

CO5: Familiar with alternative development processes

Section A

Object orientation and Development, OO Benefits, Abstraction, OO Modeling, The Three Models: Class Modeling (Objects and Classes, Relationships, Generalization and Inheritance, Association, Aggregation, Constraints, Packages), State Modeling (Events, States, Transitions and Conditions, State and Behavior, Concurrency) and Interaction Modeling (Use case models, Sequence and Activity) [12]

Section B

System and Process, SDLC, Creation of SRS document: Requirement Specification, Documentation and SDLC Models. Domain and Application Analysis (Class, State and Interaction Models), System Design (Subsystems, Global Resources, Conditions, Priorities), Using design patterns (Abstraction-Occurrence, General Hierarchy, Player-Role, Singleton, Observer, Delegation, Adapter and Proxy Patterns), Class Design (Use cases, algorithms, refactoring, design optimization, inheritance adjustment) [12]

Section C

UML Diagram: Use case diagram, Class diagram, Object diagrams, Aggregation activities on real

objects(Aggregation, Generalization relations, Association and multiplicity), Activity diagram(Activity and state diagram), Interaction Diagram(Sequence diagram, Collaboration diagram, Component diagram.) [10]

Section D

OO Methodologies (Structured Analysis, Structured Design (SA/SD), Jackson Structured Development (JSD), Information Modeling Notations), OMT as SE Methodology, OO Impact, OO Style (Reusability, Extensibility, Robustness, Programming-in-the-large), User centric design and usability principles, Reverse Engineering, Difficulties and risks in use-case modeling and UI design, System testing and maintenance.Use of open source tools for UML Design such as Plant UML, Argo UML. [10]

TEXT BOOKS:

1. Frederick Eddy, James Rumbaugh, Michael Blaha, Willliam Premerlani, William Lorensen: Object-Oriented Modeling and Design, Pearson Education.
2. James Rumbaugh, Michael R. Blaha: Object-Oriented Modeling and Design with UML, Pearson Education.
3. Timothy C. Lethbridge, Robert Laganiere: Object Oriented Software Engineering, Practical Software Development using UML and Java, Tata McGraw-Hill edition.
4. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.

REFERENCE BOOKS:

1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. AtulKahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Mark Priestley: Practical Object-Oriented Design with UML, TATA McGraw Hill.
5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and
6. Unified Process, Craig Larman, Pearson Education.

Course Code: PGCA 403

Course Name: Cyber Laws and IPR

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Acquire knowledge about various Information Systems.
CO2: Understand the key security requirements of Confidentiality, Integrity &Availability.
CO3: Demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO4: Apply Symmetric Encryption techniques.
CO5: Describe the concept of Security policies and Cyber Laws.

Part A

Cyber World: Introduction to Cyberspace and Cyber law, Different components of cyber laws, Cyber law and Netizens, The Zero-Day Attack and Mutation in delivery, Crimeware Toolkits and Malicious Softwares: Types of Malicious Software (Malware)-Viruses, Worms, SPAM E-mail, Trojans, Zombie, Bots, Key loggers, Phishing, Smishing, Whaling, Spyware, Backdoors. [6]

Defensive measures of Cyber security: Denial-of-Service Attacks, D-DoS, Defenses against Denial-of-Service Attacks Virtual Private Networks (VPN) and Access control, Preventive Measures, The Firewall, The Intrusion Detection System (IDS) and The Intrusion Prevention System (IPS), Integrated defense for an enterprise network. [8]

Intellectual Property Rights: IPR regime in the digital society, International treaties and conventions, Business software patents, Domain name disputes and resolution, Intellectual property issues in cyber space Domain names and related issues, Copyright in the digital media. [8]

Patents: Objectives, Rights, Assignments, Defenses in case of infringement, Copyright Objectives, Rights, Transfer of copyright. Work of employment infringement, Defenses for infringement. Trademarks Objectives, Rights, Protection of Goodwill, Infringement, Passing off, Patents in the cyber world. [8]

IT ACT 2000: Aim and objectives, Overview of the Act, Information Technology Act-2000-1 Information Technology Act-2000-2, Information Technology Act-2000-3, Information Technology Act-2000-4, Information Technology Act-2000-5, Information Technology Act- 2000-6, Amendments in IT Act Jurisdiction, Role of certifying authority, Regulators under IT Act, Cybercrimes, offences and contraventions. Grey areas of IT Act. [10]

Case Study: Case studies of infringement of cyber laws and IPR in Government sector, corporate sector, Financial sector. [4]

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.
2. Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India, 2014.

Reference Books:

1. Christof Paar , Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010

2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.
3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

Course Code: PGCA 407

Course Name: Cloud Computing

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective-II
Total marks: 100	

Course Outcomes

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics.
CO2: Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.
CO3: Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO4: Analyze various cloud programming models and apply them to solve problems on the cloud.
CO5: Understand the advantages and challenges brought about by the various models and services in cloud computing.

Section-A

Cloud Computing**:** Basics of emerging cloud computing paradigm, Deployment models, Reference models, Cloud cube model, Cloud software and service providers, Cloud migration, Benefits and challenges to cloud computing, Characteristics of Clouds .Virtualization: Concept and types, Advantages of Virtualization, Taxonomy of virtualization, Physical and logical partitioning, Migration and deployment of virtual machines, XEN, QEMU, VMware, Hyper-V etc., Uses of virtual server consolidation. [10]

Section-B

Cloud Storage: Architecture of storage (S3), Different storage models, Blobs, Buckets, Tables, ACL, Storage network design considerations, NAS and Fibre channel SANs, Global storage management locations, scalability, operational efficiency. [12]

Section-C

Cloud Security: Trust models for clouds, Security and disaster recovery, Security base line, Fear Uncertainty Doubt and Disinformation factor, Challenges, Data center security recommendations, Statement of audit standards, Cloud security alliance, Recovery time objectives and vendor security process [12]

Section-D

Cloud Monitoring: Architecture for federated Cloud Computing, Service Oriented Architecture, Foundation for SLA, Components of the SLA, Selected business use cases. Demystifying the Cloud: Using case studies like Hadoop, Google App Engine, Amazon EC2, Eucalyptus, Open Nebula etc. [10]

Recommended Books:

1. *Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing: Principles and Paradigms, John Wiley and Sons (2011).*
2. *David E.Y. Sarna, Implementing and Developing Cloud Computing Applications, CRC (2011).*
3. *William von Hagen, Professional Xen Virtualization, Wrox Publications, (2008).*
4. *Chris Wolf , Erick M. Halter, Virtualization: From the Desktop to the Enterprise, APress (2005).*
5. *George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publishers (2009).*

Course Code: PGCA 408

Course Name: Network Security & Administration

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective-II
Total marks: 100	

Course Outcomes

CO1: Undertake routine tasks to secure a network.
CO2: Understand the factors that place an internet-based information system at risk
CO3: Evaluate procedures to secure a system against failure, theft, invasion and sabotage.
CO4: Understand and apply the concepts for administrating a small company's network.
CO5: Apply knowledge to simple case studies to implement network security.

Section-A

Security Attacks –Passive & Active Attacks, Security Services, Security Mechanisms, Model for Internetwork Security,Man –In – the middle attack, Meet – in – the middle attack Conventional Encryption Principles, Monoalphabetic ciphers, Playfair Ciphers, Transposition Ciphers, Cipher block chaining mode, approaches of message authentication. [12]

Section-B

Public Key cryptography Principles, RSA algorithm, Digital Signatures , Digital Certificates, Certificate Authority and Key management Kerberos, X.509 Directory Authentication Service. [10]

Section-C

IP Security: Security Problems of IP, Security Objectives, IP Security Protocol Modes, Authentication Header, Security Payload.
Firewall Characteristics, Types of Firewalls and their practical use, NAT [12]

Section-D

Email Security: PGP, S/MIME
Web Security: Security Socket Layer, Transport Layer Security, Secure Electronic Transaction. [10]

Text Books:

1. Handbook of Applied Cryptography - Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone
2. Network Security and Cryptography – Bernard Menezes
3. Network Security Essentials – William Stallings
4. Data Communication and Networking-Behrouz A. Forouzan

Course Code: PGCA 409
Course Name: Big Data Analytics

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective - I
Total marks: 100	

Course Outcomes

CO1: Apply knowledge of statistics, science and programming skills, to solve of complex analytical problems related to big data and business analytics.
CO2: Identify, formulate, and analyze business analytical problems concerning and demanding big data.
CO3: Design and evaluate fully distributed model of big data to solve real time problems.
CO4: Make use of research-based knowledge to identify the appropriate data collection methods, apply statistical methods to analyze, synthesis and interpretation of data, to provide valid conclusions.
CO5: Function in multi-disciplinary teams through groups while working on mini-project concerning business analytical problems.

Section-A

Introduction to Data Analytics: Data and Relations, Data Visualization, Correlation, Regression, Forecasting, Classification, Clustering.
Big Data Technology Landscape: Fundamentals of Big Data Types, Big data Technology Components, Big Data Architecture, Big Data Warehouses, Functional vs. Procedural Programming Models for Big Data. [10]

Section-B

Introduction to Business Intelligence: Business View of IT Applications, Digital Data, OLTP vs. OLAP, Why, What and How BI? , BI Framework and components, BI Project Life Cycle, Business Intelligence vs. Business Analytics
Big Data Analytics: Big Data Analytics, Framework for Big Data Analysis, Approaches for Analysis of Big Data, ETL in Big Data, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Role of Data analyst. [14]

Section-C

Business implementation of Big Data: Big Data Implementation, Big Data workflow, Operational Databases, Graph Databases in a Big Data Environment, Real-Time Data Streams and Complex Event Processing, Applying Big Data in a business scenario, Security and Governance for Big Data [8]

Section-D

Big Data on Cloud, Best practices in Big Data implementation, Latest trends in Big Data, Latest trends in Big Data, Big Data Computation, More on Big Data Storage, Big Data Computational Limitations, Introduction to most recent advancements in Big Data technology along with their usage and implementation with relevant tools and technologies [12]

Recommended books:

1. Michael Minelli, Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series (2013), 1st ed.
2. T. white, Hadoop: The Definitive Guide, O' Reilly Media (2012), 3rd ed.

Course Code: PGCA 404
Course Name: Major Project

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

To provide the hands on experience in analyzing, designing and implementing various projects, students are assigned major projects based on the languages they have learned so far. Based on the project work a project report should be prepared under the guidance of faculty and submitted to department for evaluation.

Course Code: PGCA 405
Course Name: Interactive Computer Graphics Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes

CO1: Understand the structure of modern computer graphics.

CO2: Develop and design drawings that demonstrate computer graphics and design skills.
CO3: Make use of the key algorithms for modeling and rendering graphical data.
CO4: Develop, design and problem solving skills with application to computer graphics.
CO5: Creating programs in C++ to implement various graphical features like clipping, filling etc.

List of Experiments

1. Write a program to plot a pixel on the screen in a particular color.
2. Write a program for creating a simple two-dimensional shape of any object using lines, circle, etc.
3. Using different graphics functions available for text formatting, write a program for displaying text in different sizes, different colors, font styles.
4. Implement the DDA algorithm for drawing line (programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants)
5. Write a program to input the line coordinates from the user to generate a line using Bresenham's method and DDA algorithm. Compare the lines for their values on the plotted line.
6. Write a program to generate a complete moving wheel using Midpoint circle drawing algorithm and DDA line drawing algorithm.
7. Write a program to draw an ellipse using the Midpoint ellipse generation algorithm for both the regions.
8. Write a program to draw any 2-D object and perform the transformations on it according to the input parameters from the user, namely: Translation, Rotation or Scaling.
9. Write a program to rotate a triangle about any one of its end coordinates.
10. Write program to draw a house like figure and perform the following operations.

a) Scaling about the origin followed by translation.
b) Scaling with reference to an arbitrary point.

11. Write a program for filling a given rectangle with some particular color using boundary fill algorithm.
12. Write a program for filling a polygon using Scan line Polygon fill algorithm.
13. Write a program to perform clipping on a line against the clip window using any line clipping algorithm. The output must be twofold showing the before clipping and after clipping images.
14. Write a program to implement the Sutherland Hodgeman algorithm for clipping any polygon.

Course Code: PGCA 406
Course Name: Object Oriented Analysis & Design with UML Lab

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Practical	**Percentage of numerical/design problems**: -
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Course Outcomes:

1. Identify the fundamental principles of OO programming.
2. Understand key principles in OO analysis, design, and development.
3. Analyze the application of the Unified Modeling Language (UML) towards analysis and design.
4. Implement the common patterns in OO design
5. Understand the alternative development processes.

List of experiments:

1. To develop a problem statement.
2. Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart).
3. Identify Use Cases and develop the Use Case model.
4. Identify the business activities and develop an UML Activity diagram.
5. Identity the conceptual classes and develop a domain model with UML Class diagram.
6. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7. Draw the State Chart diagram.
8. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
9. Implement the Technical services layer.
10. Implement the Domain objects layer.
11. Implement the User Interface layer.
12. Draw Component and Deployment diagrams.