Semester Syllabus for Postgraduates
As recommended by Board of Studies of Computer Science and Applications
Barkatullah University, Bhopal

Class: M. Sc. Computer Science   Semester I (for Regular Students only)

Paper Code	Paper Title	Internal	Theory	Grand Total
MSCS -101	Discrete Mathematics Structures	15	85	100
MSCS -102	Programming skills with C++	15	85	100
MSCS -103	Computer Organization & Architecture	15	85	100
MSCS -104	Office Tools	15	85	100
MSCS -105	**Lab-I**(programming with c++)			50
MSCS -106	**Lab-II**(Office tools)			50
			Grand Total	500

Paper Code :MSCS-101
Paper Title: Discrete Mathematics Structures   **Max.Marks: 85**

Unit I
Mathematical Logic: Statements and notations, Connectives: Negation, Conjunction, Disjunction. Statement formulas and truth tables, Conditional and Biconditional,Well formed formulas.Tautologies, Equivalence of formulas, duality law, Tautological implications, contradiction contingency, Algebra of propositions, the predicate calculus: predicates, the statement function, Variables and Quantifiers, predicate formulas, free and bound variables, the universe of discourse.

Unit II
Set Theory:Basic concepts of set theory, notation, inclusion and equality of sets, the power set,types of sets, operations on set , Venn diagrams , some basic set identities,the principle of specification, ordered pains, Cartesian products, relations & ordering.

Unit III
Algebraic Structures: Introduction, algebraic system: examples and its general properties, semigroups and monoids: definitions and examples, homomorphism of semigroups and monoids, grammars and languages, Polish expressions and their compilations: polish notations, conversion of infix expressions to polish notation.

Unit IV
Lattices and Boolean Algebra: Lattices and algebraic systems , principle of duality , basic properties of algebraic systems defined by lattices, distributive and complemented lattices,Boolean lattices   and boolean algebra , identity of Boolean algebraic Boolean functions and Boolean expressions, normal forms, simplification of logic expressions using Karnaugh map,switching circuits .

Unit V
Graph Theory: Introduction, basic terminology, multi-graphs and weighted graphs , digraphs and relations , representation of graphs : incidence matrix, adjacency matrix , operations on graphs, path and circuits, Graph traversal: Depth first search, breadth first search, shortest paths in weighted graphs.

Text Books& Reference Books:
1. J. P. Tremblay , "Discrete Mathematics structures with application to computer science"
2. C.L. Liu**, "**Element of discrete mathematics"
3. J.K Sharma , "Discrete Mathematical", Macmillan publication

Paper Code :MSCS-102
Paper Title :PROGRAMMING WITH C ++   Max.Marks: 85

Unit-I
OOPS :Introduction to oops principles, procedure oriented programming vs. object oriented programming, advantages ofOOPs, applications, examples of object oriented languages. Introduction to C++ : tokens, expressions, keywords, identifiers, basic data types, user defined data types, derived data types, symbolic constants, type compatibility, variable declaration, dynamic initialization of variables, reference variables.Operators in C++: scope resolution operator, memory management operators, manipulators, type cast operators, operator precedence .Control structures
Arrays: single, multidimensional, array of strings. Functions: function prototyping, function call, scope rules of functions, call by value, call by reference, calling functions with arrays.

Unit-II
Classes and Objects : specifying a class, defining member function,private member functions, scope resolution operator, memory allocation for objects, static data members, static member functions, arrays of objects, objects as function arguments, returning objects, Inline functions, friend functions.
Pointers: pointer variables, operators and expressions, initializing pointers, array of pointers, this pointer, C++ dynamic memory allocation operator.
Constructors: definition, types: default, copy, parameterized ,multiple, constructors with default arguments, Destructors.

Unit-III
Overloading : definition, rules of overloading,function overloading,Operator overloading and its restrictions, overloading unary and binary operators, operator overloading using a friend function.

Unit-IV
Inheritance: derived class and base class, defining derived classes, types of inheritance- single, multiple, multilevel, hierarchical, hybrid inheritance. Making a private member inheritable, passing parameter to the base class, constructors and destructors in derived classes, nesting of classes.Virtual Base class, abstract classes.
Template, Template Classes, Explicit Class, Exception handling, Exception Handling Fundamentals, The try Block, the catch Exception Handler, The throw Statements.

Unit-V
Managing console I/O operations: C++ streams, stream classes, unformatted and formatted i/o operations, managing output with manipulators.Working with files: classes for file stream operations, opening and closing files, detecting end of file, sequential i/o operations, command line argument.

Text Books& Reference Books:
1. Herbert Schildt , "C++ The complete reference", TMH
2. E.Balaguruswamy, "Object Oriented Programming in C++".
3. E.RobertLafore , "Programming in C++".
4. John Hubbard , "Outline of Programming with C++" (Schaum Series)
5. M Kumar , "Programming inC++ made simple".

Paper Code: MSCS-103

Paper Title: Computer Organization & Architecture   **Max.Marks: 85**

Unit-l

Data Representation: Data Types (Number System - Octal and Hexadecimal Number, Decimal Representation, and Alphanumeric Representation), Complements, Fixed Point and Floating-Point Representation.

Digital Logic Circuits: Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Combination Circuits: Adder, subtractor, multiplexor, DEmultiplexoretc. Flip-Flops : SR Flip-flops, D Flip-Flops, JK Flip-Flops, T Flip-Flops, Edge Triggered Flip-Flops,master-slave, Execution Table, Sequential Circuits.

Unit-II

Register Transfer and Micro-operations: Register Transfer Language, Register Transfer, Bus and Memory Transfer, Micro operations : Arithmetic, Logical, Shift Micro- operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory Reference Instruction, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer.

Unit-III

Programming the Basic Computer: Machine language, Assembly language, The Assembler, Program Loops, programming arithmetic and logic operations, input-output programming, character manipulation, program interrupt.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC and CISC Characteristics.

Unit-IV

Memory Organization: Introduction, memory hierarchy, main memory, auxiliary memory, Associative memory, cache memory, locality of reference, hit/miss ratio, various mapping process: Associative mapping, direct mapping, and Set-Associative mapping, memory management hardware.

Unit-V

Input-Output Organization: Peripheral Devices -ASCII alphanumeric Characters, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Access (DMA), Input-Output Processor (lOP), Serial Communication.

Introduction to parallel processing, pipelining. Introduction to multiprocessors.

Text Books & Reference books:

1. M.MorrisMano , "Computer System Architecture", PHI.
2. Heuring Jordan , "Computer System Design & Architecture" (A.W.L.)
3. William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
4. V. Carl Hamacher, "Computer Organization", TMH
5. Tannenbaum, "Structured Computer Organization", PHI

Paper Code: MSCS-104
Paper Title: Office Tools   **Max. Marks: 85**

Unit-I
Introduction to Windows: Features of Windows. Difference between CUI & GUI Interfaces,Hardware Requirement for Running Version of Windows. New Installation &Upgradation, Managing Hardware & Software - Installation of Hardware & Software, Desktop, Start Button, Start Menu,Wall Paper, Use of Recycle Bin, Computer, Network Icon, Using Scanner Web Camera, Printers, Searching files and programs,Multiple User Feature of Windows, Creating and Deleting User, Changing User Password, etc. Creating folder and shortcuts of application on desktop, Using Windows Explorer, Accessories, Control Panel: Display, Internet Options, User Accounts, Backup and Restore, Date and Time, Taskbar, Start Menu, Windows Firewall, Windows Update, Devices and Printers.

Unit-II
System Tools - Backup, Character Map, Clipboard Viewer, Disk Defragmenter, Drive Space, Scandisk, System Information, System Monitor, Disk Cleanup, Browsing the Web with Internet Explorer and other browsers,
Accessibility Features of Windows - Sharing Folders and Drives, Browsing the Entire Network, Using Shared Printers. OLE - Embed/Link Using Cut and Paste an Embed/ Link, Using Insert Object Manage Embedded/Linked Object.
Introduction to Word Processing (**MS Word)** Advantages of Word Processing, Introduction & Installation Editing a File, Working with '**options'** under file menu, Formatting Tool Bar, Setting margins, orientation and size of page.
Using Paragraph Styles, Formatting Text, Inserting page number, Format Painter, Spell Check & Word Count, Newspaper Style Column, Drop Cap, Header & Footer, Endnote and Footnote.

Unit-III
Advanced Features of MS-Word: managing page breaks and section breaks, Inserting Objects, Inserting Hyperlink, Cross reference, Bookmark. Inserting Illustrations(Smart Art, Shapes, Charts & Pictures), Adding symbols, signature & equations, Setting Up Printer, Printing options, Inserting watermark, Mail Merge, printing labels and envelops, Mathematical Calculations, Using Macros,Table Handling, Creating Table of Contents & Index, Use of Thesaurus, saving document versions, comparing two versions of document, protecting document.

Unit-IV
Introduction to Spread Sheet(MS Excel): Definition and Advantages ofElectronic Worksheet Working on Spreadsheet, Range and Related Operations,Inserting, Deleting, Copying and Moving of Data Cells, Inserting and Deleting Rows and Columns, ProtectingCells, protecting worksheet and workbook, Printing a Worksheet, Graph Creation: Types of Graphs, Creating a Chart on Chart Sheet, Printing the Chart. Sort & Filter, Data Validation, Consolidate data, Goal seek, Data Table, Subtotal, Group & ungroup data. Freeze panes, split window, conditional formatting, inserting comment, pivot table, text to column/ column to text, what-if-analysis. Importing data from access, from web and from other sources.built in functions- mathematical, logical, text, date& time, lookup and reference.Working with '**options'** under file menu.

Unit-V

Introduction to MS Power Point: Elements of Power Point, Exploring Menus of Power Point, Working with Dialog Boxes, Creating presentation with Auto content Wizard, Designing Presentation: Slide Setup, Adding Text, Formatting Text, Inserting Photo Album, WordArt, Graph, Object   and Picture to Slide, Inserting , deleting and duplicating slides, Adding movie and sound to slide, Adding animation to slide, Custom Animation, Slide Transition, Protecting Presentation, Printing Slides, View Slide, Outline, Slide Sorter Notes and Slides Show.

Text Books:

1. Kevin Wilson, Essential Office 365 Second Edition: The Illustrated Guide to using Microsoft Office (Computer Essentials), Elluminet Press
2. Lisa A. Bucki, Word 2013 Bible, Wiley
3. John Walkenbach, Excel 2013 Bible, Wiley
4. FaitheWempen, PowerPoint 2013 Bible, Wiley

Paper Code: MSCS-105   Lab I   (C++ Programming)   Max.Marks: 50

Suggested List of Practicals

1. Define a STUDENT class with Roll No., Name, and Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the student details.
2. Write a volume function which calculates the volume of sphere, rectangle and cylinder using function overloading.
3. Write a program to find roots of Quadratic equation ,displaying the answer, whether roots are equal ,real or complex..
4. Write a C++ program to demonstrate private, public and protected access specifiers.
5. Write a program to implement single and multiple level inheritance.
6. Write a C++ program to create a class called COMPLEX and implement the following overloading functions ADD that return a complex number:
    (i)   ADD(a, s2) – where 'a' is an integer (real part) and s2 is a complex number
    (ii)   ADD(s1, s2) – where s1 and s2 are complex numbers
7. Write a C++ program to create an ACCOUNT class which has a parameterized constructor for inputting values of account number, name and balance. Class should also contain three more functions-Deposit for adding amount, Withdraw for subtracting amount(if account balance is more than withdrawal amount)and Print_Details for printing the whole account details.
8. Write a C++ program to create a template function for sorting of integers and doubles.
9. Write a C++ program to create a class called STUDENT with data members Roll No., Name and Age. Using inheritance, create the classes UGSTUDENT and PGSTUDENT having fields as Semester, Fees and Stipend. Enter the data for at least 5 students. Find the semester-wise average age for all UG and PG students separately.
10. Write a program to create a file and then write some text into the file through C++ program.
11. Write a C++ program to write and read values using variables in/from file.
12. Write a C++ program to write and read object using read and write function.
13. Write a program implementing basic operation of class ios i.e. setf, unsetf, precision etc.
14. Write a program to implement I/O operations on characters. I/O operations includes inputting a string, Calculating length of the string, Storing the string in a file, fetching the stored characters from it, etc.
15. Write a program to copy the contents of one file to another.
16. Write a program to perform read/write binary I/O operation on a file (i.e. write the object of a structure/class to file).
17. Write a program to maintain elementary database of students using files.

Paper Code: MSCS-106 Lab II (Office Tools) Max.Marks: 50

Suggested List of Practicals

I. System Tools &MS Word

1) Usage of System Tools(Backup, Character Map, Clipboard Viewer, Disk Defragmenter, Drive Space, Scandisk, System Information, System Monitor, Disk Cleanup etc.)
2) Printing documents with even-odd pages on both sides on a network printer.
3) Revision of basic tools of MS-Word.
4) Implementing Newspaper Style Column, Drop Cap.
5) Use of Header & Footer, Endnote and Footnote
6) Learning to manage page breaks and section breaks
7) Inserting Objects, Hyperlinks, Cross reference, Bookmark, Illustrations,symbols, signature & equations, watermark.
8) Mail Merge, printing labels and envelops, Mathematical Calculations, Using Macros.
9) Table Handling, Creating Table of Contents & Index.
10) Protecting documents.

II. MS Excel

1) Revision of basic formulaes of MS-Excel.
2) Protecting cells, worksheet and workbook
3) Applying Sort & Filter, Data Validation, Conditional Formatting
4) Formulaes: and, or, if, sumif, sumifs, countif, countifs
5) Implementing Pivot Table

III.MS Powerpoint

1) Adding animation to slide, Custom Animation, Slide Transition
2) Creation of Photo Album, with automatic transition of slides in 10 seconds with loopback on end
3) Creation of presentation with continuation of single audio during whole presentation(despite of slide change)
4) Printing using Handouts

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Class: M. Sc. Computer Science   Semester II (for Regular Students only)

Paper Code	Paper Title	Internal	Theory	Grand Total
MSCS-201	Data Structures and Algorithms	15	85	100
MSCS -202	Advanced Computer Networks	15	85	100
MSCS -203	Advanced RDBMS	15	85	100
MSCS -204	Information Storage Management	15	85	100
MSCS -205	**Lab-I**(Data Structures & Algorithms)			50
MSCS -206	**Lab-II**(Advanced RDBMS)			50
			Grand Total	500

er Title: DATA STRUCTURES AND ALGORITHMS   Max. Marks: 85

Unit I

Data Representation: Introduction, Linear List, Formula Based Representation, Linked representation, Indirect Addressing, Simulating Pointers.

Arrays and Matrices: The abstract data type, Operations: traversing, insertion, deletion, searching(linear & binary search) and their algorithms, row major & column major representation. Matrices: definition and operations, Special Matrices, Sparse Matrices.

Unit II

Stacks: The Abstract Data Type, PUSH & POP operations, Array representation, Linked Representation, Applications: Post fix expression evaluation and its algorithm, transforming infix expressions into postfix expressions, its algorithm, parenthesis matching, Tower of Hanoi, Re-arranging railroad cars, Rat in a maze problem.

Queues: The Abstract Data Type, array representation, Linked Representation, Insertion and deletion algorithms. Applications, circular queue, Dequeue.

Unit III

Binary and other Trees: Trees, Binary Trees, Properties, Representation, Common Binary Tree Operation, Binary Tree Traversal, The ADT Binary Tree,

Binary Search tree, abstract data type, searching, inserting and deleting in binary search trees their algorithms, AVL Trees, Introduction to Red-Black Tree and B-Tree,
Tournament Trees: Introduction, Winner Tree, The ADT Winner Tree, Loser Tree Applications.
Priority Queues: Introduction, Linear List, Applications .
Heaps: Definition, max heap initialization, insertion/ deletion in a max heap, Applications: Heapsort, machine scheduling, Huffman codes.

Unit IV

Linked Lists: representation in memory, traversing, searching, insertion, deletion operations and their algorithms, doubly linked lists, header linked list.

Graphs : Definitions, Applications, Properties, The ADT Graph. Representation of unweighted graphs: adjacency matrix, linked adjacency lists, array adjacency list, representation of weighted graphs, Graph Search Methods: depth first search and breadth first search and their algorithms..

Unit V

The Greedy Method: Optimization Problems, The method , Applications.

Paper Code: MSCS- 202
Paper Title: ADVANCED COMPUTER NETWORKS   Max. Marks:85

Unit I
Introduction: Protocols and standards, Standards Organizations, Internet Standards, Internet Administration; Overview of reference models: The OSI model, TCP/IP protocol Suite, Addressing, IP versions. Connectors, Transceivers and Media converters, Network interface cards and PC cards, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

Unit II
IPV6: Why IPV6, basic protocols, extension & option, support for QOS, Security, etc, neighbor discovery, auto- configuration, routing. Change to other protocols. Application Programming interface for IPV6. 6Bone.
Introduction to Cryptography: Basic Terms-Plain Text, Cipher Text, Encryption, Decryption, Cryptography, Cryptanalysis, Cryptology, Secret Key, Cipher Principles-Security, Attacks, Services and Mechanisms, Classical Encryption Techniques-Substitution and Transposition Techniques.

Unit III
Mobility in Network: Mobile, Security related issues, IP Multicasting, Unicast Routing Protocols – RIP, OSPF, BGP, Multicasting Routing Protocols, Host Configuration: BOOTP AND DHCP .

Unit IV
TCP extensions for high speed networks, Transaction oriented Applications, ARP, RARP, Internet Protocol, ICMP, IGMP, TCP, UDP, Introduction to Socket & Ports, Socket Class, Methods of Socket.

Unit V
Network Security at various layers, Secure-HTTP, SSL, PSP, authentication Header, Key distribution protocols, digital Signature, Digital Certificates, Firewalls.
IT Act & Cyber Laws : Cyber Crime and Cyber Laws, Types of Cyber Crimes, Cyber Law Issues in E-Business Management, Overview of Indian IT Act, Information Technology Act 2000, International Scenario in Cyber Laws: Data Protection Laws in EU and USA, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

Textbooks & Reference Books:
1. A. S. Tanenbaum, "Computer Networks", Pearson Education.
2. Behrouz A. Forouzan, "TCP/IP Protocol Suite", 3rd Edition, Tata McGraw Hill.
3. W. Stallings, "Data and Computer Communication", Pearson Education.
4. Forouzan, "Data Communication and Networking", 2nd Edition, Tata McGraw Hill.
5. W. Stallings, "Computer Network with Internet Protocols", Pearson Education.
6. Eugene Blanchard , "Introduction to Networking and Data Communications"
7. J. Martin, "Computer Network and Distributed Data Processing", PHI.
8. P S Gill, " Cryptography and Network Security", Trinity press.
9. Sood,―Cyber Laws Simplified, Mc-Graw Hill

Paper Code: MSC 203
Paper Title: ADVANCED RDBMS **Max.Marks: 85**

Unit I
The Database Life Cycle (DBLC): Initial Studyof The Database, Database Design, Implementation and Loading, Testing And Evaluation, Operations and Maintenance.
Database Administration: The Role of Database Administrator, Modeling Enterprise Data, Planning for Databases, Managing Data Security, Backing Up Databases, Controlling Concurrent Access, Managing Data Quality, Data Dictionaries and Repositories.

UNITII
Transactions: ACID properties, states of transaction, Concurrent executions, concepts of serializability and recoverability,
Concurrency control: Overview of Locking,modes of locking: shared & exclusive, 2 phase locking protocol, time stamping, Timestamp-ordering protocol, validation-based protocol, multi-versioning ,Deadlock Handling.
Recovery: transaction failure classification, stable storage implementation, log based recovery, Shadow paging, recovery with concurrent transactions, checkpoints & rollback.
Security & Integrity: security measures for protection of data at various levels, authorization, views, granting of privileges, security specifications in SQL, encryption**.**

Unit III
Database System architectures: Centralized systems, Client-Server Systems**:** Architecture And Implementation, transaction servers, data servers**,** Parallel systems, parallel database architectures, Distributed systems and databases **:** Introduction, distributed database transparency features, levels of data and process distribution: SPSD (Single site Processing, Single-site data), MPSD (Multiple Site Processing, Single-site data), MPMD (Multiple –Site Processing, Multiple- Site data).Advantages and disadvantages of distributed database systems.

UNITIV
PL/SQL: Introduction, the SQL execution environment, the PL/SQL syntax, block structure – declarative part, executable part, exception handling part, variable declaration using %type, %rowtype, if statements, looping structures, oracle transactions, cursors & its types, cursor attributes, nesting of cursors, parameterized cursors, error handling in SQL.
Concurrency control: Locks, implicit locking, levels of locks, explicit locking, select for…update statement, using lock table statement.

UNIT V
Error handling: user named exception handlers for i/o validation and business rule validation.
Stored Procedures and Functions: creating a stored procedure or function, syntax for declaration, execution and exception handling parts, advantages of using procedure or function. Deleting a procedure or function.
Database Triggers: Introduction, use, database triggers v/s procedures, database triggers v/s declarative integrity constraints, how to apply triggers. Types of triggers, Creating a trigger, deleting trigger.
User defined error messages through Raise_Application_Error Procedure.

Text Books& Reference Books:

1. Abraham Silberschatz, Henry Korth, S. Sudarshan, "Database System Concepts" McGraw Hill
2. Rajesh Narang "Database Management System" PHI
3. C.J. Date , "An introduction to database system "
4. Bipin C. Desai, "An Introduction to Database System".
5. RamakrishnanGehrke, "Database management system".
6. Ivan Bayross, "SQL PL/SQL: The programming language of Oracle", BPB Publications

Paper Code: MSCS-204
Paper Title: Information Storage Management   Max.Marks:85

Unit I
Introduction to Storage Technology: Data proliferation and the varying value of data with time &
usage, Sources of data and states of data creation, Data centre requirements and evolution to
accommodate storage needs, Overview of basic storage management skills and activities, The five pillars
of technology, Overview of storage infrastructure components, Evolution of storage, Information
Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.

Unit II
Storage Systems Architecture: Intelligent disk subsystems overview, Contrast of integrated vs. modular
arrays, Component architecture of intelligent disk subsystems, Disk physical structure components,
properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot
sparing, Physical vs. logical disk organization, protection, and back end management, Array caching
properties and algorithms, Front end connectivity and queuing properties, Front end to host storage
provisioning, mapping, and operation, Interaction of file systems with storage, Storage system
connectivity protocols.

Unit III
Introduction to Networked Storage: JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached
Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN):
elements & connectivity, Fiber Channel principles, standards, & network management principles, SAN
management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity
protocols (NFS, CIFS, ftp), & management principles, IP SAN elements, standards (SCSI, FCIP, FCP),
connectivity principles, security, and management principles, Content Addressable Storage (CAS):
elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview
including technologies like virtualization & appliances.

Unit IV
Introduction to Information Availability: Business Continuity and Disaster Recovery Basics, Local
business continuity techniques, Remote business continuity techniques, Disaster Recovery principles &
techniques.

Unit V
Managing & Monitoring: Management philosophies (holistic vs. system & component), Industry
management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management
metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend
analysis, Reactive and pro-active management best practices, Provisioning & configuration change
planning, Problem reporting, prioritization, and handling techniques, Management tools overview.

Textbook & Reference book:
1. Antonio Cantiago, Information Storage and Management: Storing, Managing, and
   Protecting Digital Information, Wiley, ISBN: 9788126521470
2. Information Storage and Management: Storing, Managing, and Protecting Digital
   Information in Classic, Virtualized, and Cloud Environments, ISBN-13: 978-
   1118094839, ISBN-10: 1118094832, Wiley
3. Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS,
   iSCSI, InfiniBand and FCoE, Ulf Troppens and Rainer Erkens, Wiley

Suggested List of Practicals

1. Write a choice based menu driven program to traverse an array, insert an item at the kth position in the array and delete item at kth position from the array.
2. Write a program for matrix multiplication.
3. Write a program to find the maximum number from the given array elements
4. Write a program to implement PUSH & POP operations on a stack using array.
5. Write a program for evaluation of a postfix expression using stack
6. Write a program for conversion of infix expression into postfix expression using stack
7. Write a program for parenthesis matching of given expression using stack.
8. Write a program for selection sort.
9. Write a program for quick sort.
10. Write a program for merge sort.
11. Write a program for linear search.
12. Write a program for binary search.
13. Write a program to implement insertion and deletion operation on queue using array.
14. Write a program to implement linked list.
15. Write a program to implement binary tree.

MCS 206: Lab-II (**Advanced RDBMS)**   **Max. Marks: 50**

SUGGESTED LIST OF PRACTICALS

1. Write a PL/SQL code to create an employee database with the tables and fields specified as below. a) Employee b) Works c) Company d) Manages Note: Primary keys are underlined.

2. Write a PL/SQL code to create a student database with the tables and fields specified as below. a) Student (Roll_no, student_name, course , gender) b) Student_personal (Roll_no,dob, fathers_name, address, city)   c) Student_enrollment (Roll_no, course, course code, sem, total_marks,percentage).

3. Write a PL/SQL code to calculate the total and the percentage of marks of the students in four subjects from the table- Student with the schema given below. STUDENT (RNO , S1 , S2, S3, S4, total, percentage)

4. Write a PL/SQL code to display employee number, name and basic of 5 highest paid employees.

5. Write a PL/SQL code to calculate the total salary of first n records of emp table. The value of n is passed to cursor as parameter.

6. Write a PL/SQL code to update the salary of employees who earn less than the average salary.

7. Write a row trigger to insert the existing values of the salary table in to a new table when the salary table is updated.

8. Write a trigger on the employee table which shows the old values and new values of Ename after any updations on ename on Employee table.

9. Writ a PL/SQL procedure to find the number of students in first, second, and third division respectively in each course by using database tables as described in problem 2 above . Also write the code to call your procedure.

10. Create a stored function that accepts 2 numbers and returns the addition of passed values. Also write the code to call your function.

11. Write a PL/SQL function that accepts department number and returns the total salary of the department. Also write a function to call the function.

Semester Syllabus for Postgraduates
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Class: M.Sc.Computer Science Semester III(for Regular Students only)

Paper Code	Paper Title	Internal	Theory	Grand Total
CS-301	Linux & shell programming	15	85	100
CS-302	Compiler Design	15	85	100
CS-303	Programming skills with Java	15	85	100
CS -304	Elective- I	15	85	100
CS -305	**Lab-I(Linux& Shell Programming)**			50
CS -306	**Lab-II(Programming skills with Java)**			50
			Grand Total	500

Electives: Sem III –

1. Data Warehousing and Mining
2. Operations Research
3. Software Engineering

Paper Code: MSCS-301
Paper Title: LINUX & SHELL PROGRAMMING   Max. Marks: 85

Unit I
Introduction: Definitions, functions and types of operating system, System components, Operating system Structure, System Calls, System Programs, Interrupts, Microkernel . **Process Management:** Process Concepts, Process states & Process Control Block, Process Scheduling: Scheduling Criteria, Scheduling Algorithms (Preemptive & Non- Preemptive) –FCFS, SJF, RR, Priority, Multiple-Processor, Real-Time, Multilevel Feedback Queue Scheduling. **Process Synchronization:** Critical Section Problem, Semaphores, Classical Problems of Synchronization and their Solutions, Deadlock Characterizations, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

Unit II
Memory Management: Introduction, Address Binding, Logical versus Physical Address Space, Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms.
File & Disk Management: Concept of File System(File Attributes, Operations, Types), Functions of File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree- Structured, Acyclic-Graph, General Graph), Allocation Methods (Contiguous, Linked, Indexed) Disk Management: Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK), Swap Space Management, Disk Reliability, Recovery, Security: Security Threats, Protection, Trusted Systems, Windows Security.

Unit III
Linux Basics: Introduction to Linux: History, GNU Movement, System Organization (Kernel and Shell), Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software, Linux, Linux Architecture, Linux File System .
Types of user-Root user(#) and normal user($), Multiple logins at same time(Ctrl + Alt + F1,F2..F6),Help: whatis, --help, man command, ,init and run levels.
Linux Installation, touch, ls, ls -l, ls -la, mkdir, rm, rm –rf, cat, cat > file, cat >> file, cp, move, rename, rm, who. Use of /, all directories under /, absolute path & relative path.Basic calculator, date utilities.
Vim Editor :Command mode & Insert mode, cut, yank, undo.

Unit IV
Linux Administration : Managing multiple processes, changing process priority with nice, cron commands, kill, ps.
Filter Commands: tr, head, tail, last, grep, sort, piping. Find Command with various options.
Managing user accounts- Sudo, users: useradd, usermod&userdel, passwd, Group creation: Primary & Secondary Group, chgrp, chown, permissions: adding and removing permissions. Package installation through GUI/ apt-get/yum/dnf.Process, Swap, Partition, fdisk.

Unit V
Shell Programming: Types of Shells, Shell Meta Characters - $#, $*,$?, Shell Variables, Shell Scripts, Debugging scripts, echo, read, operators, keywords, Integer Arithmetic and String Manipulation, Decision Making: if-else-elif-fi, case-esac. Loop Control: while, for, until, break &continue.,Functions, I/O Redirection and Piping, Exception Handling.
Creating shell programs for automating tasks, file handling, trapping signals etc.

Suggested Readings
1. Evi Nemeth , "Linux administration handbook", Pearson publications
2. Christopher Negus, "Linux Bible", Wiley Publications
3. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill Publication
4. Steve Parker, "Shell Scripting: Expert Recipes for Linux, Bash and more",Wrox Publication
5. Richard Blum, Christine Breshnahan, "Linux Command Line and Shell Scripting Bible", Wiley Publications

Paper Title: MSCS-302
Paper Code: COMPILER DESIGN   Max.Marks: 85

Unit I
Introduction to finite automata, Nondeterministic Finite Automata , transition diagrams, transition tables, acceptance of input strings by automata, deterministic finite automata, conversion of NFA to DFA, construction of NFA from regular expression.

Unit II
Compilers and translators, Features of a good compiler, Interpreter, Comparison of interpreter and compiler, The structure of a compiler, Error handling, Compiler writing tools, some typical compiler structures, Bootstrapping, cross compiler, context free grammar. The formal definition of a context free grammar, Notational conventions, derivations, parse trees and derivations, ambiguity, regular grammars and regular expressions.

Unit III
Lexical Analysis : The Role of the lexical analyzer, lexical analysis versus parsing, Tokens, patterns and lexemes, Attributes for tokens, lexical errors, the need for lexical analysis, input buffering : Buffer Pairs, Sentinels, specification of tokens, Recognition of tokens.

Unit IV
Syntax Analysis : Introduction, The role of the parser, parsers, Representation of a parse tree, Parsing techniques : Bottom up parsing, shift reduce parsing, handles, handle parsing, stack implementation of shift reduce parsing, constructing a parse tree, operator precedence parsing, operator precedence relations from associativity and precedence, the operator precedence parsing algorithm. Top down parsing, elimination of left recursion, recursive descent parsing, preductive parsers.

Unit V
Symbol Tables : The Contents of a symbol table, Names and symbol table records, recurring symbol table space, indirection in symbol table entries, storage allocation information, data structures for symbol table : Lists, search trees, /hash table errors, classification of errors, lexical and syntax errors, semantic errors, Run time errors.

Textbooks & References books :

1. Affred V .Aho, Jeffery D Ullman, "Principles Of Compiler Design", Narosa Publications
2. Affred V. Aho Ravi Sethi, JfeeryD.Ullman Ullman , "Compilers Principles, Techniqes And Tools"
3. D.M. Dhamdhere, "Compiler Construction Principles & Practices"
4. John E-Hopcoft, Rajeev Motwani, Jeffery D.Ullman, "Introduction To Automata Theory, Language And Computation"
5. A.I.Holub, "Compiler Design"

Paper Code: MSCS-303
Paper Title: PROGRAMMING SKILLS WITH JAVA   **Max. Marks: 85**

Unit I

An overview of java, History and design features of java, how java works, java virtual machine (JVM) ,Java development kit(JDK) ,Java Vs C++,

Data types, Variables, and constants, Arrays, Operators , Control statements- Branching, Looping and Jumping

Object-Oriented Programming: Classes Objects, and methods : defining a class, adding variables and methods, creating objects, ,Constructors, Implementing & Designing Classes.

UnitII

String and string buffer classes , Wrapper classes . Inheritance, -Types of inheritance ,Accessspecifiers , using super, method overriding . Packages and interface-,Importing package , standard java packages .

Defining and implementing interface, Extending interface, Nested interface, Multiple Inheritance.

Exception handling, fundamentals, exception types, uncaught exceptions, throws, throw, try-catch, final, built in exceptions, creating your own exceptions.

UnitIII

Multithreading fundamentals, java thread model: priorities, synchronization, messaging, thread class, Runnable interface. Java collections.Input/output-basics-streams, byte and character streams, predefined streams, reading and writing from console and files

Networking –basics, networking classes and interfaces, using java.net package, Sockets- doing TCP/IP and datagram programming.

UnitIV

Application Vs Applets- using the tools in JDK, javadoc, java, jdb etc.

Applets programming-creating and executing java applets , inserting applets in a web page , java security.

Java Graphics fundamentals.AWT classes, event handling and swing classes, AWT programming, working with windows, graphics and text, using AWT controls, layout managers and menus, handling image, animation, sound and video.Event handling- different mechanism, The delegation event model, event classes, event listener interfaces, adapter and inner classes.Java swing applet, icons and labels, text fields, buttons, combo boxes, tabbed and scroll panes, trees, tables.

UnitV

JDBC Overview,Connection Classes and interfaces,JDBC ODBC Bridge, Servlets, Life cycle of servlet,Cookies, - RMI - Remote Method Invocation   2 tier 3 tier Architecture, Object serialization,CORBA - JINI overview.

JAVA BEANS AND SWING Bean concepts , Events in bean box - Bean customization - Persistence - Application - deployment using swing - Advanced swing techniques - JAR file handling

Textbooks & Reference books :
1. E.Balaguruswamy,Programming with java .
2. Schildt : Java Complete Reference TMH.
3. Deitel&Deitel , "Java How to program" , Prentice Hall , 4 th Edition.
4. Gary Cornell and Cay S. Horstmann, "Core Java Vol 1 and Vol 2", Sun Microsystems Press.
5. Stephen Asbury, Scott R. Weiner, Wiley, "Developing Java Enterprise Applications".

Paper Code: MSCS- 304   **Elective I**

(i) DATA WAREHOUSING & MINING   **Max. Marks: 85**

Unit I
Introduction to Data warehouse: Need for strategic information, Decision support system, Knowledge discovery & decision making, , need for data warehouse, Evolution, Definition, Data warehousing Components, Data warehouses and data marts, meta data, Planning your data warehouse, Data Warehouse Architecture, Data Warehouse Backend Process: Data Extraction, Data Cleaning, Data Transformation, Data Reduction, Data loading and refreshing. ETL and Data warehouse.

Unit II
Data modeling strategies: Multi dimensional data models, Fact tables, Data Cube presentation of fact tables, Star Schema, Snowflake schema, Fact Constellation. **OLAP technology:** Characteristics , Major features and functions, drill down and roll-up, OLAP Models: MOLAP and ROLAP. Physical design consideration, Indexing, Data ware house deployment activities. **Introduction to Data Mining:** Data Mining Functionalities, Classification of Data Mining Systems, Integration of Data Mining System with a Database or Data Warehouse System Data Preprocessing: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Unit III
Mining Frequent Patterns, Associations, and Correlations: Basic Concepts of Association Rules, Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, Association Mining to Correlation Analysis, Constraint-Based Association Mining. Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Introduction, Bayesian Classification, Rule Based Classification, Associative Classification, Lazy Learners, Other Classification Methods, Prediction.

Unit IV
Cluster Analysis: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Unit V
Advanced Topics: Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Textbooks & Reference books:
1. PAULRAJ PONNAIAH , "Data Warehousing Fundamentals", Wiley Student Edition.
2. Jiawei Han and MichelineKamber , "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers
3. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics‖, Pearson Education
4. Alex Berson and Stephen J. Smith ―Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition,
5. K.P. Soman, ShyamDiwakar and V. Ajay , "Insight into Data mining Theory and Practice", E EE, Prentice Hall.
6. G. K. Gupta , "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India

Unit I

Linear Programming Problem (LPP): Introduction to LPP, Components of LPP, Formulation of LPP, Graphical Solution of LPP, Exceptional Cases in Graphical Solution, Slack and Surplus Variable, Basic Solution, Basic Feasible Solution, Unbounded Solution, Infeasible Solution Optimal Solution, Standard and Matrix Form of LPP, Advantages, Applications and Limitation of LPP. Simplex Method, Pre Conditions of Simplex Method, Concept of Artificial Variables, Two-Phase Method, Big-M Method, Disadvantages of Big-M Method over Two-Phase Method.

Unit II

Dual Linear Programming Problem: Concept of Duality, Primal-Dual Relationship, Dual Simplex Method, Difference between Simplex and Dual Simplex Method, Advantage of duality, Revised Simplex Method, Advantages of Revised Simplex Method over Simplex. **Integer Programming Problem:** Introduction, Difference between LPP and IPP, Mixed and All Integer IPP, Gomory's Cutting Plane Method, Branch and Bound Method, Geometrical Interpretation of Branch and Bound Method.

Unit III

Transportation Problem: Introduction and Applications of Transportation Problem, Basic Feasible Solution of Transportation Problem, North-West Corner Method, Matrix Minima Method, Row Minima Method, Column Minima Method, Vogal's Approximation Method, Degeneracy in TP, Loops in TP, Optimal Solution (U-V method), Unbalanced Transportation Problem. **Assignment Problem:** Introduction and Application of Assignment Problem, Hungarian Algorithm for Assignment Problem, Maximization Case of AP, Unbalanced Assignment Problem.

Unit IV

Inventory Management: Introduction, Types of Inventories, Various Costs Involved in Inventory Decisions, Economic Order Quantity (EOQ), Determination of EOQ by Tabular Method and Graphical Method, EOQ Model without Shortage, EOQ model with Shortage, Inventory Model with Price- Break. **Replacement Problem:** Concept of Replacement, Replacement without Considering Money Value, Present Worth Factor (PWF), Replacement Considering Money Value, Group Replacement.

Unit V

Queuing Theory: Introduction, Characteristics of Queuing System, Transient and Steady States, Memory-less Distribution, Exponential and Poisson Process, Markovian Property, Erlang Distribution, Distribution of Arrivals, Distribution of Service Times, Kendall's Notations, Pure Birth Process, Birth and Death Model. **Non Linear Programming Problem (NLPP):** Introduction, Graphical Solution of NLPP Kuhn-Tucker Condition, Quadratic Programming, Wolf_s Method.

Suggested Readings:
1. Gillet B.E, "Introduction to Operation Research, Computer Oriented Algorithmic approach", TMH Publications.
2. P.K. Gupta & D.S. Hira, "Operations Research", S.Chand& Co Publications.
3. J.K. Sharma, "Operations Research: Theory and Applications", Mac Millan Publication.
4. S.D. Sharma, "Operations Research", KedarNath Ram Nath Publications.
5. S.S. Rao ―Optimization Theory and Application‖, Wesley Eastern Publications.
6. Tata Hamdy, ―Operations Research‖, Fifth Edition, Prentice Hall of India.
7. Taha H.A. ―Operations Research --An Introduction‖, McMillan Publications.
8. Harvey M. Wagner, ―Principles of Operations Research with Applications to Managerial Decisions‖, PHI.
9. Hilier and Liebermann, ―Introduction to Operations Research‖, McGraw-Hill.
10. Wayne Winston, ―Operations Research: Applications and Algorithm, Cengage.
11. Paul A. Jensen, ―Operational Research Models and Methods, John Wiley.

Paper Code: MSCS- 304   **Elective I**
(iii) SOFTWARE ENGINEERING   **Max. Marks:85**

Unit I
Introduction : Types of software, Software Components, Software Characteristics, Software Engineering , Scope and necessity of Software Engineering, Software Engineering Processes, Factors affecting Quality and Quantity of Software. Software Development Life Cycle (SDLC), **Software Models:** Water Fall Model, Prototype Model, RAD Model, Evolutionary Development Models (Spiral Model, Incremental Model ,Concurrent Development Model)

Unit II
Software Requirement Analysis: Requirement Specifications: Need for SRS, Nature of SRS, Characteristics, Components of SRS. Requirements analysis: Review and Management of User Needs, Feasibility Study, Information Modeling, IEEE Standards for SRS, Various SRS Templates, Validation of SRS. **Software Metrics and Measurement:** Software Process and Project Metrics, Software Measurement, Cyclomatic Complexity Measures: Control Flow Graphs, Software Quality Metrics. **Software Project Planning:** Objectives, Scope, Software Cost Estimation: Decomposition Techniques: Software sizing , Problem Based Estimation, Line of Code(LOC) Vs Function Point (FP) Based Estimation, Process Based Estimation; Empirical Estimation Models: The COCOMO Model; Make/Buy Decision, Software Risk Management.

Unit III
Software Analysis & Design using both Conventional and Object Oriented approach: Analysis: Analysis Model, Process and various Documents. **Conventional Analysis:** Data Modeling (ER Diagram), Functional Model & Information Flow (DFDs), Behavioral Modeling, Structured Analysis, Data Dictionary. **Object Oriented Analysis:** Domain Analysis, Object Oriented approach Process (Use Case), Object-Relational Model, Object- Behavioral Model. **Design: Conventional Design:** Design Process, Principles & Concepts, and Design Model. **Object Oriented Design:** Design Issues, Design Process: System Design, Object Design. **Software Design Document:** Software Design Document & its various example templates: Data Design, Architecture Design, Interface Design & Procedural Design. **Coding:** Coding, Code Debugging**,** Code Verification and Code Optimization.

Unit IV
Testing, Deployment & Maintenance: Objectives of Testing, Types of Software Testing, Testing for Functionality and Performance, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suite Preparation, Levels of Testing: User, Integration, System Alpha and Beta Testing, User Acceptance of Products, Roll out of Software & Deployment Issues. What is Maintenance, Need for Maintenance, Categories of Maintenance: Corrective, Preventive, Adaptive and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering, Software Reuse.

Unit V
Introduction to Software Project Management (SPM): Software Configuration Management (SCM), Software Version Control. Software Quality Management**,** Software Quality Assurance (SQA), Software Reliability & Reliability Models, Clean Room Software Engineering Approach.
CASE Tools: Overview of CASE Tools Framework, Features, Advantages and Limitations of CASE Tools, Awareness about Some Commercial CASE Tools, Use and Applications.

Textbooks & Reference books:
1. R. S. Pressman, ―Software Engineering: A Practitioners Approach, McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
3. PankajJalote, ―Software Engineering, Wiley.
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, ―Fundamentals of Software Engineering, PHI Publication.
5. Ian Sommerville, ―Software Engineering, Addison Wesley.
6. KassemSaleh, "Software Engineering", Cengage Learning.
7. Pfleeger, ―Software Engineering, Macmillan Publication.
8. Stephen R. Schach, ―Classical & Object Oriented Software Engineering, IRWIN.
9. James Peter, W. Pedrycz, ―Software Engineering John Wiley & Sons.
10. Michael Dyer, ―The Cleanroom approach to Quality Software Engineering‖, John Wiley & Sons.

MSC- 305   Lab I: Linux and Shell Scripting

1. **Linux Commands:**

   - mkdir
   - cd
   - rm, rm -f
   - cp
   - move
   - rename
   - cat, cat >, cat >>
   - find command: -name, -uname, -size, -ctime, -mtime
   - Search a given string in a file(grep command)
   - Making group: groupadd command
   - useradd with -d, -s, -c, -g, -G switch
   - usermod
   - userdel, groupdel
   - ls, ls –l, chmod(with alphabetic or numeric permissions)
   - Chown and chgrp command
   - Edit Crontab file to wall message on system on particular time automatically.

2. **Vi editor:**
   1. Create file, edit, save and quit
   2. highligting the searched term within a file
   3. cut, yank, undo

3. **Shell Scripting:**

   1. Write a shell script to print a message.
   2. Write a shell script to access arguments passed on command line.
   3. Write a shell script to create files with the names passed on command line.
   4. Write a shell script to input number from user and display its factorial.
   5. Write a shell script to input file name and create multiple directories individually for the name in the file given.
   6. Write a shell script to input number from user and display whether it is prime number or not.
   7. Write a shell script to list all the files in any directory given by the user
   8. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory

A. Core Java Programming Lab(Using any Text editor)

1. Write a Program to find sum & average of 10 no. using arrays.
2. Find greater number between two numbers.(Using conditional operator.)
3. Find the factorial of number if number is given by user using command line argument.
4. Write a program to display grade according to the marks obtained by the student.
5. Write a program to convert the given no. of days into months & days using with classes, objects and   method.
6. Write a program to convert given string into Uppercase and lowercase and get the length of string using array.
7. Create a package called "Arithmetic" that contains methods to deal all arithmetic operations. Also write a program to use the package.
8. Define an exception called "Marks out of Bound" exception that is thrown if the entered marks are greater than 100.
9. Using application of single inheritance. Write a program to Find the area of rectangle & volume of cube.
10. Develop a simple real life application to illustrate the use of multithreading.
11. Write a program using multiple inheritance calculate area and parameter of a circle
12. Write a program which takes input from keyboard and sends output to the console.

B. Advanced Java Programming Lab (Using NetBeans/Eclipse)

1. Design a web page having blue color background and white color text with title „student details‟ .
2. Design a web page having three hyperlinked text and two hyperlinked images.
3. Design a web page to create a registration form having name, address, password, gender, course, nationality, skill and CV with appropriate GUI control.
4. Write an applet program to draw a   Filled Rectangle. (color = orange)
5. Write a Program in java netbeans to find whether a no. is prime or not.
6. Write a program in java netbeans to find whether a no. is even or odd.
7. Write a program in java netbeans to find area of a right-angled triangle
8. Write a program in netbeans to implement JDBC.
9. Write a program innetbeans to calculate **simple** interest**.**
10. Write a program innetbeans to accept employee data and insert into oracle table.

Semester Syllabus for Postgraduates
As recommended by Board of Studies of Computer Science and Applications
Barkatullah University, Bhopal

Class: M. Sc. Computer Science Semester IV (for Regular Students only)

Paper Code	Paper Title	Internal	Theory	Grand Total
CS-401	Big Data Analytics	15	85	100
CS-402	Multimedia & Computer Graphics	15	85	100
CS-403	PHP &MySQL	15	85	100
CS -404	Elective- II	15	85	100
CS -405	**Lab-I(Big Data Analytics)**			50
CS -406	**Lab-II(PHP & MySQL)**			50
CS-407	**Project**			100
			Grand Total	600

Electives: Sem IV –

1. Enterprise Resource Planning
2. Cloud Computing
3. Artificial Intelligence

Paper Code: MSC 401
Paper Title :BIG DATA ANALYTICS   **Max.Marks: 85**

Unit-I
Introduction to Big Data: Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce.

Unit-II
Introduction to Hadoop: Hadoop Architecture,Big Data – Apache Hadoop&HadoopEcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce- Data Serialization

Unit-III
HDFS, HIVE AND HIVEQL, HBASE:HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Unit-IV
SPARK: Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.

NOSQL:NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vsNoSQL, NewSQL.

Unit-V
Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Text Books & Reference books:
1.   Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2.   SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.
3.   Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4.   Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5.   Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
6.   AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7.   Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
8.   Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
9.   Pete Warden, "Big Data Glossary", O'Reily, 2011.
10.   Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
11.   ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012
12.   Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012

Paper Code: MSCS-402
Paper Title: MULTIMEDIA & COMPUTER GRAPHICS   Max.Marks:85

Unit-I
Devices: storage tube graphics display - raster scan displays, random scan systems, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Scan Conversion techniques, line drawing: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms. Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms

Unit-II
2D transformations: Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogenous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping, Cohen Sutherland, Midpoint Line clipping algorithms, Polygon Clipping: Sutherland – Hodgeman, Weiler-Atherton algorithms.

Unit-III
3D transformations: translation, rotation, scaling.Parallel & Perspective Projection, Types of Parallel & Perspective Projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painters algorithm, Z-buffer algorithm. Curve generation, Bezier and B-spline methods. , Diffuse reflection, Specular reflection, Phong Shading,Gourand shading, ray tracing, color models like RGB, YIQ, CMY, HSV.

Unit-IV
Multimedia : Multimedia Terms, Multimedia Hardware, Basic tools in Multimedia, , Uses of Multimedia, Multimedia System Architecture, Text –Types ,text compression, Text file formats RTF, TIFF, hypertext and hypermedia Audio- Components of an audio system, Digital **Audio:** digital audio, MPEG,MIDI, processing sound, sampling, compression, Sound cards, Audio file formats ,Audio Processing softwares.

Unit-V
Video: Analog and Digital Video, Introduction to graphics accelerator cards, intro to AV/DV and IEEE1394 cards, Video file formats, compression standards.
Animation: Uses of Animation, Principles of Animation, Computer based animation,2D and 3D Animation techniques, Animation file formats, Animation softwares, Compression.

Textbooks & Reference books:
1. Donald Hearn and M.P. Becker, "Computer Graphics" ,Pearson Pub.
2. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill
3. FolayVandam, Feiner, Hughes, "Computer Graphics Principle & Practice" , Pearson Pub.
4. Sinha and Udai , "Computer Graphics", Tata McGraw Hill
5. Parekh, "Principles of Multimedia", Tata McGraw Hill
6. Prabhat k Andleigh, KiranThakral , "Multimedia System Design " PHI Pub.
7. Shuman, " Multimedia in action".

Paper Code: MSCS-403
Paper Title:PHP& MySQL   Max. Marks: 85

UNIT I

BASICS OF PHP: Introduction to PHP, what does PHP Do?, Object Oriented Programming with PHP, language basics, installation of XAMPP/LAMP, syntax, comments, variables, constants and data types, expressions and operators, flow control statements, including html code in PHP, embedding PHP in web pages.

UNIT II
FUNCTIONS & STRINGS: Defining a function, Calling a function, variable scope, function parameters, return values, predefined functions.
Strings: Creating & accessing string, searching and replacing strings, encoding and escaping, comparing strings, formatting strings, regular expression.

UNIT III
Data & File Handling: PHP Forms: $_GET, $_POST, $_REQUEST, $_FILES, $_SERVER,
$GLOBALS, $_ENV, input/output controls, validation, Cookies and Sessions.
File Handling: File and directory, open, close, read, write, append, delete, uploading and downloading files. File exists, File Size, Rename. Reading and display all/selected files present in a directory.

UNIT IV
MYSQL AN OVERVIEW: Introduction, phpMyAdmin, Entering queries, Creating and using a database, Creating and selecting a database, creating a table, loading data into a table, Retrieving information from a table, selecting all data, selecting particular rows, selecting particular columns, sorting, date, calculations, working with NULL values, pattern matching, counting rows, using more than one tables.

UNIT V
MYSQL DATABASES IN PHP: Introduction, connecting to a MySQL database, querying the database, Retrieving and displaying the results, modifying data and deleting data through front end. Designing applications using PHP & MySQL.

Text Books & References:
1. PHP & MySQL, VikramVaswani, McGraw-Hill
2. The Complete Reference - PHP, Steven Holzner, McGraw-Hill
3. The Complete Reference – MySQL, VikramVaswani, McGraw-Hill
4. Beginning PHP 5.3, Matt Doyle, Wrox Publication
5. PHP for the Web covers PHP5 & 7, Larry Ullman
6. Programming PHP, RasmusLerdorf, Kevin Tatroe, Bob Kaehms, RicMcGredy, O'REILLY.
7. "PHP 5 Recipes, A problem solution approach", Lee Babin, Nathan A. Good, Frank M. Kromann, and Jon Stephens, Apress

Paper Code: MSCS-404   **Elective II**

(i)ENTERPRISE RESOURCE PLANNING   **Max.Marks:85**

Unit I
History of ERP, Concept of ERP System, Reasons to go for ERP, Need of ERP, Evolution of ERP, Structure of ERP, Concept of Material Requirement Planning (MRP), Manufacturing Resource Planning (MRP II), Common Misconceptions about ERP, Benefits of ERP, Disadvantages of ERP, ERP and Related Technologies, MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information System), Data Warehouse, Data Mining.

Unit II
BPR (Business Process Reengineering), How ERP is related with BPR, Barriers to the Success of BPR; Role and Importance of Data Warehouse in ERP, Role of Data Mining in ERP; Supply Chain Management (SCM), Evolution and Components of SCM, Characteristics of SCM, How ERP is related with SCM; Role and Need of Customer Relationship Management, Integration of ERP, SCM and CRM.

Unit III
ERP Modules, Finance, Plant Maintenance, Quality Management, Material Management; Domain of ERP as well as areas affected by ERP e.g. Aerospace, Automobiles etc.; Market Players SAP, JD Edwards, BANN, PeopleSoft, Oracle Etc., ERP market in Indian Context; Assemble-To-Order, Make-To-Order, Make-To-Order, Just in Time (JIT); Hidden Costs involved in ERP Implementation, Planning and Project Management, Training, Data Conversion, Dirty Data, Integration Testing, Data Analysis.

Unit IV
ERP Implementation Lifecycle, Evaluation Criteria for ERP Product, Integrating ERP into organizational Culture, Critical Factors in the Success and Failure of ERP, ERP Success inhibitors, Return On Investment of ERP Implementation, Useful Guidelines for ERP Implementation, Role of Vendors in ERP Implementation, Evaluation Criteria for Vendors, Role and Need of ERP Consultants, Role of End Users in ERP Implementation, Training of End Users, Motivation for End Users.

Unit V
ERP and Internet, ERP and E-Commerce, How ERP interoperate E-Commerce, Future Directions in ERP, New Evolving Markets, Faster Implementation Methodologies, New Business Segments, Concept of Extended ERP, e-ERP, e-CRM, e-SCM, Case Study on SAP, ORACLE, People Soft etc.

Suggested Readings:
1. Alexis Leon, 'Enterprise Resource Planning Demystified', Tata McGraw-Hill Publishing Company Ltd.
2. MahadeoJaiswal and Ganesh Vanapalli, 'Text Book of Enterprise Resource Planning', Macmillan India Ltd.
3. Vinod Kumar Garg and N.K. Venkitakrishnan, 'Enterprise Resource Planning– Concepts and Practice', PHI.
4. Rahul V. Altekar, 'Enterprisewide Resource Planning', Tata McGraw Hill.
5. Joseph A Brady, Ellen F Monk, Bret Wagner, 'Conceptsin Enterprise Resource Planning', Thompson Course Technology.
6. Mary Summer, 'Enterprise Resource Planning', Pearson Education.

Paper Code: MSCS-404   **Elective II**

(ii) **CLOUD COMPUTING**   **Max.Marks: 85**

Unit I

Cloud Computing Basics: What Is Cloud Computing? Cloud Components, Infrastructure, characteristics of cloud computing, Services & Applications-Storage, Database Services, Intranets and the Cloud - Components, Hypervisor Applications, First Movers in the Cloud –Amazon, Google, Microsoft . Benefits, Limitations. Types of cloud (public, private, community and hybrid cloud), Pros and Cons of Cloud Computing

Unit II

Cloud Computing Services: Software as a Service: The Basics , Storage as a Service , Providers, Security, Reliability, Advantages, Cautions, Outages, Theft , Cloud Storage Providers. Platform as a Service: Accessing the Cloud Platforms - Web Application Framework , Web Hosting Service , Proprietary Methods , Web Applications, Web APIs , Web Browsers -Internet Explorer , Firefox , Safari , Chrome. Infrastructure as a Service: Advantages, Software Considerations, Vendor Advantages, Limitations, Driving Forces-Popularity.
Database as a Service, Monitoring as a Service, Communication as services.

UNIT III

Collaborating with cloud : Service providers- Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework. Collaborating on Calendars, Schedules and Task Management, Collaborating on Event Management, Contact Management, Project Management, Collaborating on Word Processing, Databases, Storing and Sharing Files, Collaborating via Web-Based Communication Tools, Evaluating Web Mail Services, collaborating via Social Networks, Collaborating via Blogs and Wikis.

UNIT IV

Virtualization for cloud : Need for Virtualization, Pros and cons of Virtualization, Virtualization Concerns, Security aspects of Virtualization, Types of Virtualization – System Vm, Process VM, Virtual Machine monitor, Virtual machine properties, Interpretation and binary translation, HLL VM, Hypervisors, Xen, KVM , VMWare, Virtual Box, Hyper-V.

UNIT V

Security, standards, and applications : Security in Cloud Computing, The Open Cloud Consortium, Security Management Standards: Standards for application Developers, Standards for Messaging, Standards for Security, cloud security challenges, Availability Management in SaaS, PaaS and IaaS. Access Control , Security Vulnerability, Patch, and Configuration Management, Conclusion and the future scope of the Cloud-Analyst Predictions , Survey Says?, The Future of Security in Cloud Computing. Relevant Case Studies

TEXT BOOKS & Reference books

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition)
2. John Rittinghouse& James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press
3. Antohy T Velte ,Cloud Computing : " A Practical Approach", McGraw Hill
4. Michael Miller, Cloud Computing: "Web-Based Applications That Change the Way You Work and Collaborate Online"
5. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers
6. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter-―CloudComputing a Practical Approach.
7. B.Furht; A. Escalante ――Handbook of cloud computing.
8. Majd F. Sakr -――Introduction to Cloud Computing.
9. Tim Mather, SubraKumarswamy, ShaheedLatif-―Cloud Security and Privacy.

Paper Code: MSCS-404 **Elective-II**

(iii)ARTIFICIAL INTELLIGENCE Max. Marks: 85

Unit I
Scope of AI: Games, Theorem Proving, Natural Language Processing, Vision And Speech, Processing, Robotics, Expert Systems, General Issues and Overview Of AI, AI Techniques, AI Problems. **Intelligent Agents**: Definitions Of A Rational Agent, Reflex, Model-Based, Goal-Based, And Utility-Based Agents, The Environment In Which A Particular Agent Operates. **Problem Solving** : State Space Search; Production Systems, Search Space Control; **Uninformed Search:** Depth-First, Breadth-first search. **Introduction to LISP**: Syntax and Numeric Functions, Basic List, Manipulation Functions in LISP

Unit II
Informed /Heuristic Search: Heuristic Search, Hill Climbing, Best-First Search, A*, AO* Search, Branch And Bound, Problem Reduction, Constraint Satisfaction End, Means-End Analysis. **Knowledge Representation**: Predicate Logic: Unificatioin, Modus Ponens, Resolution In Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative And Procedural Representation, Rule Based Systems **LISP (Continued):** Functions, Predicates And Conditionals, Input, Output, And Local Variables, Iteration And Recursion, Property Lists And Arrays.

Unit III
Structured Knowledge Representation: Semantic Nets: Slots, Exceptions And Default Frames, Conceptual Dependency, Scripts. **Game Playing:** Game Tree, Minimax Algorithm, Alpha Beta Cutoff, Modified Minimax Algorithm
Introduction To PROLOG: List, Operators, Arithmetic, Objects, Relationships, Facts, Rules And Variables.

Unit IV
Natural Languages and NLP, Syntactic Processing, Parsing Techniques, Semantic Analysis, Case Grammar, Augmented Transition. **Handling Inconsistent And Incomplete Knowledge:** Truth Maintenance Systems, Reasoning Techniques, Concept Of Uncertainty, Bayes' Theorem, Certainty Factors And Rule-Based Systems, Bayesian Networks, Dempster-Shafter Theory, Fuzzy Logic: Fuzzy Sets, Fuzzy Operators & Arithmetic, Membership Functions, Fuzzy Relations
PROLOG: Syntax and Data Structures, Representing Objects & Relationships By Using ─Trees And ─Lists, Cut & Fail, Backtracking.

Unit V
Learning: Concept of Learning, Learning Automation, Rote Learning, Genetic Algorithm, Learning By Inductions, Artificial Neural Nets, Expert Systems: Need and Justification for Expert Systems, Knowledge Acquisition.
AI: Present and Future.
Case Studies: Mycin, Black Board System

Textbooks & Reference Books:
1. S. Russell and P. Norvig, ─Artificial Intelligence: A Modern Approach‖ (2nd ed.), Pearson Education, 2005.
2. Elaine Rich and Kelvin Knight, ─Artificial Intelligence‖, Tata McGraw Hill, 2002.
3. Eugene Charniak and Drew McDermott, ─Introduction to Artificial Intelligence‖, Pearson Education, 2009.
4. Nils J. Nilson, ─Principles of Artificial Intelligence‖, Narosa Publishing House, 2001
5. R. Akerkar, ─Introduction to Artificial Intelligence‖, Prentice-Hall of India, 2005

6.   Dan W. Patterson, ―Introduction to Artificial Intelligence and Expert Systems‖, Prentice Hall of India, 2006.

7.   Nils J Nilson, ―Artificial Intelligence: A New Synthesis‖, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.

8.   Clocksin and C.S. Mellish, ―Programming in PROLOG‖, Narosa Publishing House, 2002. 9. SarojKaushik, ―Logic and Prolog Programming‖, New Age International Publisher, 2006

10. R. J. Schalkoff, ―Artificial Intelligence-an Engineering Approach‖, McGraw Hill Singapore, International Editions, 1992.

11. George F. Luger, ―Artificial Intelligence-Structures and Strategies For Complex Problem Solving‖, Pearson Education, 5th Edition, 2010

Paper Code: MSCS-405 **Lab I :Big Data Analytics** **Max.Marks: 50**

Suggested Practical List

1. Setting up a multi-node Apache Hadoop cluster from scratch
2. Performing file I/O using HDFS.
3. Implementing an end-to-end data pipeline with Hive
4. Creating User Defined Functions in Hive
5. Working with HBase Shell and loading data from Hive
6. Running a Map/ Reduce Job - Word Count
7. Using Eclipse to build Map/Reduce Applications
8. Deploying Map/Reduce Jobs on Cluster
9. Analyzing Stock Market Data using Pig/Latin
10. Working With Complex Data Types
11. Analyzing weather data using Hive
12. Working with Hbase Shell
13. Loading Data in HDFS, Hive &Hbase in Various formats

Paper Code: MSCS-406   Lab II :PHP & MySQL   Max.Marks:50

Suggested list of Practicals

1. Create a simple HTML form and accept the user name and display the name through PHP echo statement.
2. Write a PHP script to demonstrate arithmetic operators, comparison operator, and logical operator.
3. Write PHP Script to input marks, generate result and display grade.
4. Write PHP Script for addition of two 2x2 matrices.
5. Write PHP script to obtain factorial of a number using function
6. Write PHP script to demonstrate string, date and math function.
7. Write PHP script to demonstrate
8. Create student registration form using text box, check box, radio button, select, submit button. And display user inserted value in new PHP page.
9. Write two different PHP script to demonstrate passing variables through a URL.
10. Write two different PHP script to demonstrate passing variables with sessions.
11. Write PHP script to demonstrate passing variables with cookies.
12. Write a program to keep track of how many times a visitor has loaded the page.
13. Write PHP script to demonstrate exceptional handling.
14. Write a PHP script to connect MySQL server from your website.
15. Write a program to read customer information like cust_no, cust_name, Item_purchase, and mob_no, from customer table and display all these information in table format on output screen.
16. Write a program to edit name of customer to "Bob" with cust_no =1, and to delete record with cust_no=3.
17. Write a program to read employee information like emp_no, emp_name, designation and salary from EMP table and display all this information using table format.
18. Create a dynamic web site using PHP and MySQL.

Paper Code :MSCS-407   **Marks : 100**
Paper Title: Project :Application Developmentusing any/all technologies learnt during the course

Recommendation: The technology to be used for Project Development to be revised every 2 yrs .as per the prevailing trends and needs of the industry/market.

GUIDELINES for Project Development in M Sc. (CS) Final Semester.

- **Internal Evaluation (CCE) will be based on viva on project synopsis((i.) System study and system design, (ii.) Presentation) submitted by the student – 20 marks.**
- **External Evaluation will be based on , Viva and demonstration of the work done in the project– 80 marks**
1. Project will consist of software development taken up in a group consisting of not more than 2 students.
2. Report will be submitted jointly by the group in one copy.
3. Project can be done eitheras on-the-job training in a software development organization/ company or it can be a self effort as a suitable solution to a real world problem identified in consultation with guide teacher.

GUIDELINES FOR PROJECT FORMULATION

* TYPE OF PROJECT
It is **suggested** that the project to be chosen should have some direct relevance to the real world. Students are expected to work out a solution for real life problemsinvolving diverse application domains in some industry/development laboratories/educational institutions/software companies. However, it is not mandatory for a student to work on a live project. The student can formulate or innovatea project problem with the help of his/her Guide.

The project work will give an opportunity to the students to develop quality software solutions. Project development should involve all the stages of the software development life cycle (SDLC) like requirements analysis, systems design, software development/coding, testing and documentation, with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, and develop good understanding of SDLC.

Project Ethics to be adhered to: Plagiarism to be avoided: The project should be genuine and original in nature and should not be copied from anywhere . Students should be encouraged to work in the suggested areas listed at the end of the guidelines.

*Calendar For The Project

Sr. No.	Topic	Date
1	Assigning of teacher guide	Before 15/January
2	Topic Finalized	Before 31/January/
3	Submission Of the Project Abstract And Synopsis (**CCE 1**)	Before 10/February/
4	PPT Presentation (**CCE 2**)	Before 20 /February/
5	First proof of the Project Report to be checked by teacher guide	Before 20/March/
6	Final Submission and Viva/demonstration by external examiner	3rd week of April

* PROJECT PROPOSAL (SYNOPSIS)

The project proposal should be prepared in consultation with thementor in organisation / teacher guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project proposal should contain complete details in the following form:

1. Title of the Project
2. Introduction and Objectives of the Project
3. Relevance of the topic for the benefit of the society
4. Analysis :(DFDs at least up to second level , ER Diagrams/ Class Diagrams/ Database Design etc. as per the project requirements).
5. Design: A complete structure which includes: Number of modules and purpose of each module to provide an estimation of the student's effort on the project. Data Structures as per the project requirements for all the modules.
6. Testing process to be used.
7. Reports generation (Mention tentative content of report)
8. Tools / Platform, Hardware and Software Requirement specifications
9. Are you doing this project for any Industry/Client? Mention Yes/No. If Yes, Mention the Name and Address of the Industry or Client
10. Future scope and further enhancement of the project.

Incomplete project proposals in any respect should be given another chance and re-submitted after incorporating changes and suggestions given by the guide. CCE marks to be given based on synopsis viva.

* PROJECT REPORT FORMULATION
I.   The project report must contain the following in detail :

1. Certificate from the organization where project has been undertaken.
2. Certificate of Originality (Format given).
3. Declaration(Format given).
4. Acknowledgement (Format given).
5. Introduction
4. Objectives
5. Tools/Environment Used
6. Analysis Document (This should include SRS in proper structure based on Software Engineering concepts, E-R diagrams/Class diagrams/any related diagrams (if the former are not applicable), Data flow diagrams/other similar diagrams (if the former is not applicable), Data dictionary)
7. Design Document (Modularization details, Data integrity & constraints including database design, Procedural design, User interface design)
8. Program Description (Detailed specification instead of code), Comments & Description.)

9. Testing (Test case designs are to be included separately for Unit testing, Integration testing, System testing; Reports of the outcome of Unit testing, Integration testing, System testing are to be included separately. Also, details of debugging and code improvement are to be included.)
10. Input and Output Screens
11. Implementation of Security for the Software developed (In case, you have set up a User Name and Password for your software, you should ensure the security of User Name and Password during transmission to server)
12. Limitations, future scope for improvement/enhancement of the Project
13. Application of the project mentioning benefit to the real world
14. Bibliography/ References
15. Synopsis

II.   The Project Report may not be more than 80 1.5mm spaced A-4 size typed pages .
III. Executable file of the project must be submitted in soft copy attached at the back of the project report.

IV. The project report should be hard bound; should consist of a Contents page; all pages of report should be numbered; content should be well organized in a meaningful manner; printouts of text & screen layouts should be original and should not be xeroxed)

 *__Important Points For Preparation & Submission of the Project Report__

1. The Project Report should be submitted in A-4 size typed in 1.5mm line space, justified. (Font Times New Roman, size normal 12 , Heading 16 and Subheading 14)
2. The length of the report should be between 50 to 80 pages including the cover page, summary, table of contents, list of figures, list of tables, and acknowledgement.
3. Ensure that Project Synopsis and the final report contain the signatures of both the Guide and the student along with date.
4. If any project report is received in the absence of the items listed above, it will be rejected and returned to students for compliance. Also, violation of Project Guidelines may lead to rejection of the Project .
5. Spiral bound photocopy of the project report is to be submitted to the College. Original copy of the same Project Report is to be retained with the student and the student is supposed to carry his copy while appearing for viva voce.
6. If the title and content of the Project differs from the title mentioned in the Project Proposal, the Project Report should be rejected by the external examiner and valuation to be done accordingly.

*Suggested list of topics for Application Development

A sample list of topics for Project development is provided below. This is just a suggested list and students are free to choose any other innovative project relevant to computer applications **which can be developed using any technology learned during the course.**

- Customer Targeted E-Commerce
- Automated Faculty Evaluation System
- Online Health Shopping Portal With Product Recommendation
- College Forums with Alumni With Content Filtering
- Sql Injection Prevention System
- College Social Network Project
- ERP System
- Online Book Recommendation Using Collaborative Filtering
- Monitoring Suspicious Discussions On Online Forums
- Fake Product Review Monitoring & Removal For Genuine Ratings
- A Commodity Search System For Online Shopping Using Web Mining
- Secure Online Auction System
- Farming Assistance Web Service
- Online Loan Application & Verification System
- Matrimonial Portal
- Online Herbs Shopping Project
- Online Bakery Shop System
- Course Material Distribution System
- Online Furniture Shop Project
- Hotel Room Comparison System Project
- Salon management System
- Sports Club Management Project
- Online Blood Bank Project
- Stationery Management System
- Online Application for the Training and Placement
- Online Leave Management System
- Airline Reservation System
- Recipe Management System
- Complaint Management System
- Web Based Meeting Scheduler
- Student Project Allocation And Management
- Ticket Reservation System
- Content Management System
- Call Center Management
- Online On-Request Courses Coordination System
- Civil Registry
- Online Career Guidance and Placement Unit
- Ad Agency
- Any other approved topic

* Formats of certificates to be included

A. Cover page:.

<div style="border: 1px solid black; padding: 20px;">

PROJECT REPORT
On
\<Project Title\>

SUBMITTED TO

Barkatullah University

\<logo of university\>

**IN PARTIAL FULLFILLENT
OF THE DEGREE OF
MASTER ofSCIENCE IN Computer Science
Session \<\>**

By

**Name : …………………………..…………
Roll No : ………………..…………………….
Enrollment No……………………………….**

Under the
Guidance of

\<Name of Internal Guide\>   **\< Name of External Guide\>**
   \<Designation \>   \<Designation\>

</div>

B. Certificate from the organization :(to be issued by the organization and the photocopyof the certificate is to be attached in the report)

C. Format for acknowledgement

ACKNOWLEDGEMENT

I convey my sincere gratitude to _____ _____ for giving me the opportunity to prepare
my project work in _____. I express my sincere thanks to all the staff
members of_____.

I am thankful to _____ for her/his guidance during my project work and
sparing her/his valuable time for the same.

I express my sincere obligation and thanks to thePrincipal and all Faculties of the Department
of_____, _____, for providing me
with guidance, help, motivation and valuable advice at every stage for completing the project work
successfully.

Signature:
Name:
Roll No:

D. Format for Declaration

DECLARATION

I do hereby declare that the project work entitled "_____"submitted

by me for the partial fulfillment of the requirement for the award of Master of Science in

Computer Science, is an authentic work completed by me. The report being submitted has not

been submitted earlierfor the award of any degree or diploma to any Institute or University.

Date:

Signature :
 Name:
Roll No:

E. Certificate of Originality

CERTIFICATE OF ORIGINALITY

This is to certify that the project report entitled _____ Submitted to Barkatullah University, Bhopal, in partial fulfillment of the requirement for the award of the degree of Master of Science in Computer Science, is an original work carried out by Mr./ Ms._____.Enrollment No.: _____ Roll.No……………….

The matter embodied in this project is a genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirement of any course of study.

Signature of the Guide
Name, Designation and
Address of the Guide