Semester Syllabus for Postgraduates
As recommended by Board of Studies of Computer Science and Applications
Barkatullah University, Bhopal
Session 2019-20 onwards

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

Paper Code	Paper Title	Internal	Theory	Grand Total
MSCS-301	Linux & shell programming	15	85	100
MSCS-302	Compiler Design	15	85	100
MSCS-303	Programming skills with Java	15	85	100
MSCS -304	Elective- I	15	85	100
MSCS -305	**Lab-I(Linux& Shell Programming)**			50
MSCS -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 & DATA MINING **Max. Marks: 85**

Unit I

Introduction toData 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,DataWarehouse 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 F ,uent 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 Topicsl, 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

Paper Code: MSCS- 304 **Elective**

ii) OPERATIONS RESEARCH **Max. Marks:85**

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 P. .lem. **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 Applicationl, Wesley Eastern Publications.
6. Tata Hamdy, —Operations Researchl, Fifth Edition, Prentice Hall of India.
7. Taha H.A. —Operations Research --An Introductionl, McMillan Publications.
8. Harvey M. Wagner, —Principles of Operations Research with Applications to Managerial Decisionsl, PHI.
9. Hilier and Liebermann, —Introduction to Operations Researchl, 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**

(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 ar 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 R m 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 Engineeringl, John Wiley & Sons.

MSC- 305 **Lab I: Linux and Shell Scripting**

Max. Marks : 50

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

MSCS- 306 Lab II: **Max.Marks:50**

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/ compound interest on choice
10. Write a program innetbeans to accept employee data and insert into oracle table.