ADMISSION & EXAMINATION BYE-LAWS

FOR

Master of Computer Applications (MCA)

CHOICE BASED CREDIT SYSTEM (CBCS) w.e.f (2020-21)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
School of Engineering Sciences & Technology
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ADMISSION & EXAMINATION RULES
for
Master of Computer Applications

1. OBJECTIVE

To prepare highly skilled professionals, with a strong conceptual and theoretical background in the fields of information technologies, especially in the emerging areas of software technologies.

2. THE PROGRAM

Highlights of the course are described in the following table:

a.	*Name of the Program*	Master of Computer Applications
b.	*Nature*	Regular and Full Time
c.	*Duration*	Two years(4 Semesters)
d.	*Total number of credits*	100
e.	*Medium of Instruction and English Examinations*	English
f.	*Eligibility Criteria*	i. Passed BCA/ BSc/ B. Com/ BA with mathematics at 10 + 2 level or at graduation level examination from a recognized institution/university securing at least 50% marks (or equivalent CGPA) in the qualifying examination.
g.	*Selection procedure*	As per the merit of the qualifying examination.
h.	*Total Seats*	60
i.	*Period of Completion*	Not more than 04 years (8 Semesters)
j.	*Commencement of the Program*	July of the every academic session

3. PROGRAMME STRUCTURE

Semester-wise course structure, guidelines for teaching, practical and associated assessment of **MCA programme** is described in the following tables:

Course Type	Abbreviation	Credits
Program Core Course	PCC	44
Program Elective	PE	12
Open Elective	OE	04
Foundation Course	FC	04
Ability Enhancement Course	AEC	02
Skill Enhancement Elective	SEE	04
Laboratory	LAB	12
Dissertation	DISS	18
Total Credits		**100**

L-T-P stands for number of contact hours as Lecture-Tutorial-Practical in a week.

Semester – I

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 101	Object oriented programming	PCC	25	75	100	3-1-0	4
MCA 102	Computer Organization and Architecture	PCC	25	75	100	3-1-0	4
MCA 103	Database Management Systems	PCC	25	75	100	3-1-0	4
MCA 104	Software Engineering	PCC	25	75	100	3-1-0	4
MCA 105	Data Communication and Computer Networks	PCC	25	75	100	3-1-0	4
MCA 106	Communication Skills	AEC	25	75	100	2-0-0	2
MCA 107	'OO Programming Lab	LAB	25	75	100	0-0-4	2
MCA 108	Database Management Systems Lab	LAB	25	75	100	0-0-4	2
					Total	**17-5-8**	**26**

Semester – II

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 201	Mathematical Foundations for Computer Applications	FC	25	75	100	3-1-0	4
MCA 202	Data Structures and algorithms	PCC	25	75	100	3-1-0	4
MCA 203	Java Programming	PCC	25	75	100	3-1-0	4
MCA 204	Operating Systems	PCC	25	75	100	3-1-0	4
	PE – 1	PE	25	75	100	3-1-0	4
	PE-2	PE	25	75	100	3-1-0	4
MCA 205	Data Structures Lab	LAB	25	75	100	0-0-4	2
MCA 206	Java Programming Lab	LAB	25	75	100	0-0-4	2
					Total	**18-6-8**	**28**

Semester – III

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 301	Formal languages and Compiler Design	PCC	25	75	100	3-1-0	4
MCA 302	Machine Learning	PCC	25	75	100	3-1-0	4
MCA 303	Data Warehousing and Data Mining	PCC	25	75	100	3-1-0	4
	PE – 3	PE	25	75	100	3-1-0	4
	SEE	SEE	25	75	100	3-1-0	4
	OE	OE	25	75	100	3-1-0	4
MCA 304	ML Lab	LAB	25	75	100	0-0-4	2
MCA 305	Lab based on SEE	LAB	25	75	100	0-0-4	2
					Total	**18-6-8**	**28**

Semester – IV

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Viva Voce	Total		
MCA 401	Dissertation/Industrial Project	DISS	300	200	500	0-0-36	18

Grand Total of Credits = 100

PROGRAM ELECTIVES (PE)

PE – 1	
MCA PE111	Artificial Intelligence
MCA PE112	Web technology
MCA PE113	Software testing and Quality Assurance
PE – 2	
MCA PE221	Data Science and Analytics
MCA PE222	Soft Computing
MCA PE223	Neural Networks and Deep Learning
PE – 3	
MCA PE331	Distributed Systems
MCA PE332	Cloud Computing
MCA PE333	Cryptography and Network Security
MCA PE334	MOOCS*

*The list of online courses to be cleared through MOOCS shall be floated in the respective semester after the approval from Board of Studies.

Skill Enhancement Electives (SEE)

SEE	
MCA SEE311	Android Programming
MCA SEE312	Linux and Unix Programming
MCA SEE313	ASP.net Programming

OPEN ELECTIVES (OE)

OE	
MCA OE311	E-Governance and Smart City
MCA OE312	Cyber physical system and IoT
MCA OE313	Sustainable Development and Green Computing

4. MODE OF CURRICULUM DELIVERY

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

5. ATTENDANCE

a. All students are supposed to attend every lecture and practical classes. However, the attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
b. Each one-period teaching shall account for one attendance unit.

c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.

d. Attendance on account of participation (with prior permission from the Head of the Department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.

e. Attendance records displayed on the Notice Board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.

f. In case a student is found to be continuously absent from the classes without information for a period of 30 days, the concerned teacher shall report it to the Head of the Department.

g. Head of the Department may recommend for striking off the name of a student from rolls, after ensuring '**one month continuous absence'**, from all the concerned teachers.

h. A student, whose name has been struck off on account of long absence may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.

i. A student with less than 75% attendance in a subject shall not be allowed to appear in that subject in the semester examination. The Head of the Department shall recommend all such cases to the Dean of the School.

j. The Dean, on the recommendation of the Head of the Department, may consider the relaxation of attendance up to 10% on account of sickness and /or any other valid reason. No application for relaxation of attendance (duly certified by a Registered Medical Practitioner/Public hospital or a competent authority) will be entertained after 15 days from the recovery from illness etc.

6. INTERNAL ASSESSMENT

a. Internal assessment, to be made by concerned teachers, will be based on minor tests, quizzes, presentation, programming test, demonstrations and assignments.

b. There will bethree (3) Internal Assessment (Unit Tests) with a total of 20 marks ,andthebesttwo (2) performances out ofthethree Unit testsof Internal Assessment will becounted.Other modes of assessment shall account for remaining 5 marks.

c. Dates for unit test will be announced at the beginning of the semester, by the examination coordinator.

d. The teacher concerned shall maintain a regular record of the marks obtained by students in unit tests and display the same in due course.

e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the Department, on the conclusion of teaching of the current semester.

f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.

g. A promoted candidate, who has to reappear in the examination of a paper, will retain internal assessment marks.

h. In the case of re-admission, the candidates shall have to go through the internal assessment process afresh and shall retain nothing of the previous year.

7. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the conclusion of each of the semesters, are presented in the following table:

S.N.	Classification	Theory	Lab
1.	Mode	Written Only	Written, Demo, Programming and viva- voce etc.
2.	Duration	03 Hours	04 Hours
3.	Total Marks	75 (Seventy Five Only)	75 (Seventy Five Only)

8. DISSERTATION/INDUSTRIAL PROJECT

a. Each student of the final semester will have to go for a Dissertation/Industrial Project work either in the industry or in the Department under the guidance of one or two faculty members.
b. Period of completion of Dissertation/Industrial Project work shall be full one semester.

c. There shall normally be two supervisors-one internal and one *external (in the case of industry project form the place where the student is pursuing project-work)*.

d. All the students, who are pursuing the Dissertation/Industrial project work, shall be continuously in touch with the internal supervisor.

e. ***There shall be a mid-term evaluation of the progress*** and the internal supervisors will conduct it. However, an internal supervisor may ask the student to submit a confidential progress-report from the external supervisor *(in the case of industry project).*

f. All the candidates shall submit ***Three (03***) hard copies of the project reports that are duly approved and signed by internal as well as external *(if applicable)* supervisors.

g. An external examiner, appointed for the purpose, shall evaluate the project report.

h. The Head of the Department shall fix a date and time for viva-voce examinations, on receipt of the evaluation-report of the project reports from the external examiner.

i. Head of the Department shall forward the compiled total marks (awarded in internal assessment, project Report and Viva-voce Examination), in the project-semester of each of the candidate, to the Controller of Examination.

9. EXAMINATION

a. The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/ tutorials, quizzes/ viva voce and attendance. The end semester examination shall be comprised of written papers, practical and viva voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

b. The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

c. The minimum pass marks in each subject including sessional marks (Theory, Practical or Project etc.) shall be 40%.

10. PROMOTION SCHEME

a. A student will be required to clear minimum **40% of his/her papers** in a semester/annual examination to be eligible **for promotion to the next semester/year**. A student may appear in the supplementary examination after each semester/annual examination and can have a choice to appear in the backlog papers in the supplementary examination or in the subsequent regular semester/annual examination with a prescribed fee. A students detained due to shortage of attendance will repeat his/her paper in the subsequent semester concerned (even/odd).

b. A **detained** Student is not allowed to re-appear in the internal assessment (Unit test). His/her old internal assessment marks will remain same.

A student who cleared all the papers of a semester/annual examination of a programme/course will be eligible for improvement examination asper university rule.

11. THE GRADING SYSTEM

As per University Rule

12. CALCULATION OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

After having passed all the FOUR semesters, the students shall be eligible for the award of **Master of Computer Applications** degree of JAMIA HAMDARD.

13. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **Master of Computer Applications**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

MCA 101 (OBJECT-ORIENTED PROGRAMMING)

Unit – I

Introduction: Introducing Object-Oriented Approach Comparisons with Procedural Approach, Characteristics of Object-Oriented Languages. Basic terms and ideas: Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference betweenC and C++, cin, cout, new, delete operators.

Unit – II

Classes and Objects: Abstract data types, Object & classes, attributes, methods, Reference variable, C++ class declaration, State identity and behavior of an object, Constructors and destructors, copy Constructor, Static Class Data, inline function, default arguments, const arguments Friend Functions.

Unit – III

Inheritance: Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Hybrid Inheritance and virtual base class Aggregation, composition vs classification hierarchies, function overriding and constructor calls in different types of Inheritance

Unit – IV

Polymorphism: Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, This Pointer, Operator overloading and Type Conversions, Parametric polymorphism, Virtual Functions, Virtual Destructors, Generic Programming – template function and Template Classes

Unit – V

Files and Exception Handling: Console I/O: Stream, stream classes, unformatted I/O operations, formatted I/O operations, manipulators. File I/O Basics of data files, creating/ opening & closing a file, reading data from file, writing data into file, error-handing functions, random access of data files. Namespaces and Exception handling

TEXT BOOKS

Balagurusamy, "Object Oriented Programming with C++", TMH

REFERENCE BOOKS

- *Stephen Prata "C++ Primer Plus" Pearson Education*
- *Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.*
- *D . Parasons, "Object Oriented Programming with C++", BPB Publication*
- *A R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997.*

MCA 102 (COMPUTER ORGANIZATION AND ARCHITECTURE)

Course Objectives:

1. The main objective of the syllabus is to make students understand the relevance Computer Organization in the software oriented course

2. It aims at introducing basic digital concepts and then use them to explain details of computer organization.

Unit – I

BASIC FUNCTIONAL BLOCKS OF A COMPUTER AND ITS REPRESENTATION: Functional units, Basic operational concepts, Bus structures, Performance and metrics, Instructions and instruction sequencing, Hardware–Software Interface, Instruction set architecture, Addressing modes, RISC, CISC, ALU design, Fixed point and floating point operations, Case study of a CPU (Intel Atom Board)

Unit – II

CPU CONTROL UNIT DESIGN: Execution of a complete instruction, Multiple bus organization, Hardwired control, Micro programmed control, Computer arithmetic, Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier etc.

Unit – III

PIPELINE: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Performance considerations, Exception handling. Case Study of Intel Atom Board.

Unit – IV

MEMORY SYSTEM DESIGN: Basic concepts, Semiconductor RAM – ROM, Speed, Size and cost, Cache memories, Improving cache performance, Virtual memory, Memory management requirements, Associative memories, Secondary storage devices. Case study of Intel Atom Board.

Unit – V

I/O ORGANIZATION: Accessing I/O devices, Programmed Input/Output, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.

TEXTBOOKS

1. John P. Hayes, Computer Architecture and Organization, MGH, 1998.

2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education, 2010.

3. M. Morris Mano, Computer System Architecture, 2nd Edition, PHI.

REFERENCE BOOKS

- *David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier, 2012.*
- *Carl Hamachar, Zvonco Vranesic and Safwat Zaky, Computer Organization, MGH, 1990.*
- *Vincent P. Heuring and Harry F. Jordan, Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 1996.*

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the operation of electronic logic elements
2. Understand the various parts of a system memory hierarchy
3. Understand the organization of a computer system in terms of its main components

MCA –103 (DATABASE MANAGEMENT SYSTEMS)

Course Objectives:

1. Define the terminology, features, classifications, and characteristics embodied in database systems.
2. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary.
3. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
4. Use an SQL interface of a multi–user relational DBMS package to create, secure, populate, maintain, and query a database.

Unit – I

Introduction to DBMS

Basics of File Processing Systems and Database Systems, Difference between traditional file system and DBMS, Responsibilities of Database Administrator, Three level Architecture of Database System, Physical and Logical data independence.

Unit – II

Introduction to various Database Models

Entity Relationship Model and its importance, Introduction to various Symbols used In ERD (Entity: Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality), Conversion of ER diagram to tables, Comparative study of Network, Hierarchical and Relational Models, Codd's 12 Rules, Comparison of Object Oriented Database and Object Relational Database.

Unit – III

Normalization in DBMS

Normalization and its various forms(1NF, 2NF, 3NF and BCNF), Functional Dependencies, Multi–valued Dependencies, Study of various Database Integrity like Domain, Entity, Referential Integrity Constraints.

Unit – IV

SQL

Categories of SQL Statements, The CREATE Statement, The DROP Command, The ALTER Command, Integrity Constraints, DML Statements: The SELECT Statement, The INSERT Statement, The DELETE Statement, The UPDATE Statement, SQL Operators: Simple Selects Comparison Operators, IN and

NOT IN Operators, BETWEEN Operator, The LIKE Operator Logical Operators, IS NULL and IS NOT NULL, ANY, ALL, SQL FUNCTIONS, Joining Tables, SQL Subqueries, GROUP BY Clause, HAVING Clause

Unit – V

Transactions

Basic concepts, ACID Properties . Concurrency control techniques: Items, locks, Deadlocks, serializability, Locking two phase locking, Database recovery technique: Failure classification, recovery concepts, recovery techniques based on deferred and immediate update, Shadow paging.

MCA 104 (SOFTWARE ENGINEERING)

Course Objectives:

1. Knowledge of basic SW engineering methods and practices, and their appropriate application.
2. Describe software engineering layered technology and Process frame work.
3. A general understanding of software process models such as the waterfall and evolutionary models.
4. Understanding of software requirements and the SRS documents.

Unit – I

Introduction, Software Model and Process: Software Crisis, Need and Definition of Software Engineering, Software Myths, Process Model: Waterfall Model, V-Model, Incremental Model, Evolutionary Model,

Unit – II

Requirement Engineering: Inception, Elicitation, Elaboration, Negotiation, Specification, Validation, Requirements, Analysis & Model: Domain Analysis, Data Flow Modeling, Class-based Modeling, CRC Modeling.

Unit – III

Software Design Concepts: Abstraction, Modularity, Cohesion, Coupling, Software Design: Architectural Design, Data Design: Entity Relationship Design, User Interface Design, Object Oriented Design, Web Application Design: Aesthetic Design, Content Design, Navigation Design

Unit – IV

Testing and Quality: Software Testing, Verification and Validation, Test Strategy: Unit Testing, Integration Testing, System Testing, User Acceptance Testing: Alpha & Beta Testing, Internal and External View of Testing: White Box Testing, Black Box Testing, Quality Concepts, Garvin's Quality Dimension, McCall's Quality Factors, ISO 9126 Quality Factors

Unit – V

Maintenance and Software Metrics: Maintenance: Corrective, Perfective, Adaptive, Metrics: Size Oriented Metrics, Function Point Metrics, CK Metrics suite, Introduction to Risk Management

TEXT BOOKS

- *R. S. Pressman, "Software Engineering – A practitioner's approach", 7th Edition, McGraw Hill Int. Ed., 1992.*
- *K. K. Agarwal and Yogesh Singh, Software Engineering, New Age*

REFERENCE BOOKS

- *P. Jalote, "An Integrated approach to Software Engineering", Narosa, 1991.*

- *Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, 1996.*
- *James Peter, W Pedrycz, "Software Engineering", John Wiley & Sons*

Learning Outcomes:

1. Basic knowledge and understanding of the analysis and design of complex systems.
2. Ability to apply software engineering principles and techniques.
3. Ability to develop, maintain and evaluate large-scale software systems.
4. To produce efficient, reliable, robust and cost-effective software solutions.

MCA - 105 (DATA COMMUNICATION AND COMPUTER NETWORKS)

Course Objectives:

1. The main emphasis of this course is on the organization and management of local area networks (LANs).
2. The course objectives include learning about computer network organization and implementation.
3. It aims at obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.

Unit – I

Transmission Media: Twisted pair, Coaxial Cable, Fiber Optics, Wireless transmission, Bluetooth, Radio, Microwave, Infrared.

Network Classifications: Study of various Types of Networks (LAN, MAN, WAN, WLAN, PAN, etc.) , Comparison of various enterprise network infrastructures (Internet, Intranet, and Extranet), Introduction to IEEE 802 family.

Unit – II

Introductory Concepts - Network hardware - Network software - Physical layer – Guided transmission media, OSI reference model

Data Link Layer –Error Detection and Correction, Data link control and protocol, Design issues - Channel allocation problem - Multiple access protocols -Ethernet - Wireless LAN - 802.11 architecture.

Unit – III

Network Layer – Addressing, Design issues, Routing algorithms, Congestion control algorithms Quality of Service , Internetworking.

Unit – IV

Transport Layer - Transport service - Elements of transport protocols - User Datagram Protocol - Transmission Control Protocol.

Unit – V

Application Layer - DNS - Electronic mail - World Wide Web - Multimedia – Network security.

TEXT BOOKS

- *A.S.TANENBAUM, "Computer Networks", Pearson Education, IV Edition, 2003*
- *W.STALLINGS, "Data and Computer Communication", Pearson Education, 2001*
- *B.A Forouzan "Data Communication and Networking"TMH*

REFERENCE BOOKS

- *Shanmavgaon, K.S. "Digital and Analog Communication System", John Wiley and Sons.*
- *Roden, M.S. "Analog and Digital Communication System", P.H.I.*
- *Scheber, W.L. "Data Communication", MGH.*

Learning Outcomes:

1. The course introduces computer communication network design and its operations.
2. On completion of the course, the student should be able in part to design, implement and maintain a typical computer network (LAN).

MCA 106 (Communication Skills)

Course Objectives:

1. To give a brief summary of rules of Grammar
2. To impart effective reading, writing, and speaking skills
3. To teach drafting and presentation skills

Unit 1: Grammar, Dictionary, and Thesaurus

Review of English Grammar; Written and Spoken language; Common Errors in language; Punctuation (purpose, role, importance and use); Effective use of dictionary, thesaurus, encyclopedia, OED; Figures of speech.

Unit 2: Language, Phonetics, and Writing

Language Skills (listening, Speaking, Reading, Writing); Meaning what you mean; Listening: Effective and efficient listening in various situations (discussions, lectures, news, seminars, speech, telephone calls etc.); Speaking: Phonetics, intonation, accent, usage; strategies for a good rhetoric; Reading: Purpose; Comprehension; Tactics and strategies for good reading; Writing: Guidelines for good writing; various writing styles (General and technical writing styles).

Unit 3: Effectiveness and Efficiency in Communication

Communication (purpose, role importance, elements); Effective and efficient communication; role of content, context and language; Spoken and written communication Presentation and delivery; Role of speaker and audience.

Unit 4: Presentation Skills

Style and body language; Discussion and presentation skills of conferences meeting, seminars.

Unit 5: Drafting the Documents

General and Technical documents (correspondence applications, letter, resumes, CV), drafts, essays, memos; minutes, notes, proposals , précis, reports, summary, synopsis, references, table of contents, acknowledgements, prologue, epilogue, revision; Use of Audio–Visual Aids: OHP, Slides, Charts, Computers etc.

Text Books:

1. Maison, Margaret M., "Examine your English".
2. R S Sharma, "Technical Writing".

Reference Books:

1. R. Sudarshanam, "Understanding Technical English".
2. Bansal, R.K. and J. B. Harrison, "Spoken English for India: A Manual of Speech and Phonetics", Hyderabad: Orient Longman, 1983.
3. Lewis, Hedwig. Body Language, "A Guide for Professionals", 2000.

Learning Outcomes:

Upon successful completion of this course, students will be able to

1. Understand the basic rules of Grammar
2. Avoid committing common mistakes
3. Read, comprehend, and pronounce correctly
4. Give effective presentations
5. Know the pitfalls of General and Technical Writings

MCA 107 'OO Programming Lab
MCA 108 Database Management Systems Lab

MCA 201 Mathematical Foundations for Computer Applications

UNIT 1: Matrix Algebra
Rank of a Matrix, Solution of equations by Matrix Method, Symmetric, skew-symmetric and orthogonal matrices, Eigen values and Eigen vectors, Cayley Hamilton Theorem.

UNIT 2: Basic Set Theory
Basic definitions, set operations, Venn Diagram, Cartesian Products, Domain and Range of Relation, Inverse Relation, Reflexive, Types of Relations: Symmetric, Asymmetric, Anti-symmetric,Transitive, Equivalence Relation, Partition, Types of functions, Inverse function, Composition of functions.

UNIT 3: Counting Techniques
Inclusion and Exclusion Principal, Pigeon-hole Principle, Permutation and Combination.

UNIT 4: Mathematical Logic
Propositions and Logical operators, Truth tables, Preposition generated by a set, Propositional Equivalence, Logical Equivalence, Algebra of Propositions, Predicates, Quantifiers.

UNIT 5: Graph Theory
Basic definitions, Types of graph, Path, Simple Path, Trail, Closed Path, Cycle, Complementary Graph, Subgraphs, Spanning Subgraph, Isomorphism Graph, Homeomorphic Graph, Connected and Disconnected Graph, Complete Graph, Labeled Graph, Regular Graph ,Bipartite Graph, Eulerian and Hamiltonian Path ,Circuit and Graph, Planar and Non Planer Graph.

MCA 202 (Data Structures)

Course Objectives:

1. To impart basic Data Structure Concepts
2. To introduce the basic concepts of Stacks, Queues, Lists, Trees, and Graphs
3. To give a brief account of Searching and Sorting Techniques

Unit – I

Arrays and Linked Lists: Storage structures for arrays, matrix, row-major, column-major, Sparse matrices. Linked list, Doubly linked lists, Circularly linked lists – Operations on polynomials, Dynamic storage management - Garbage collection and compaction.

Unit – II

Stack and Queue Stacks and queues: insertion, deletion, Stack and queue using linked list, Circular queue, Prefix, postfix, infix notation and conversions.

Unit – III

TreesBinary tree insertion, deletion, traversal (inorder, preorder and postorder), Binary Search Tree, Threaded binary tree, AVL tree, B-tree, B+-tree.

Unit – IV

Sorting and Searching Selection sort, Insertion sort, Bubble sort, Merge Sort, Heap sort, and Quick sort, sorting in linear time, Hash Tables.

Unit – V

GraphRepresentation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithm for Kruskal's and Prim's for Finding Minimum cost Spanning Trees, Dijkstra's Algorithm for finding Single source shortest paths.

TEXT BOOKS· *Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series*· *LangsamYedidyah, Augenstein J Moshe, Tenenbaum M, "Data Structures using C and C++", PHI*

REFERENCE BOOKS· *Horowitz, Sahni, Freed, "Fundamentals of Data Structures in C", Silicon Press*· *Kruse R., "Data Structures and Program Design in C", Pearson Education India*

Learning Outcomes:

Upon successful completion of this course, students will be able to

1. Demonstrate familiarity with basic data structures.
2. Use Data Structures for Problem Solving.
3. Determine which data structure to use in different scenarios and be familiar with writing recursive methods.
4. Demonstrate understanding of the properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.
5. Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, and quick sort.

MCA 203 (JAVA PROGRAMMING)

Unit – I Java Basics

Java and Internet, Difference between C++ and Java, Byte code and platform independence, Features of Java, Java Standard Edition (Java SE), Java Runtime Environment (JRE), Java Just In Time (JIT) Compiler, Installing JDK, Compiling and executing Java Application, Java Program Structure, Java Keywords, Data types, Variables, Arrays, Expressions, Operators, Control Statements, for each statement, Command Line Arguments.

Unit – II

Object-Oriented Programming – I

Class and Encapsulation, Objects, Methods, Default and parameterized Constructors, Inheritance, super and this Keywords, Static Methods, Polymorphism, Overloading, Overriding, Dynamic Method Dispatch.

Unit – III

Object-Oriented Programming – II

Abstract class, final Keyword, Interface and Multiple Inheritance, Package, Creating Package, Using Imports, static import, Access Controls, public, private, protected and default Control, Using Scanner Class for Formatted Input, Universal Superclass Object, toString() Method, Variable Argument List.

Unit – IV

String, Exception handling and Multithreading

String, Methods of String, StringBuffer and StringBuilder, Exception, try and catch Statement, Multiple catch Statements, Nested try Statement, throw, throws and finally Statements, Creating Exception Subclasses, Thread, Advantages of Thread, Creating Threads by Extending Thread Class and Implementing Runnable Interface, Creating Multiple Threads, Life Cycle of a Thread, Thread Priorities, Thread Synchronization.

TEXT BOOKS

- *Herbert Schildt, Java: The Complete Reference, Seventh Edition, DEC-06, ISBN: 9780072263855*
- *Joel Murach and Andrea Steelman, Murach's Java SE 6, ISBN-10: 1-890774-42-1;ISBN-13: 978-1-890774-42-4*

REFERENCE BOOKS

- *Katherine Sierra, Kathy Sierra, Bert Bates, SCJP Sun Certified Programmer for Java 6 Study Guide: Exam (310-065), McGraw-Hill Companies, June 2008, ISBN-13: 9780071591065*
- *Jeff Friesen, Beginning Java SE 6 Platform: From Novice to Professional, Apress*
- *Deital and Deital, Java How to Program, 8/e, Prentice Hall, 03/17/2009, ISBN: 0136123716*
- *Khalid Mughal, Rolf Rasmussen, A Programmer's Guide to Java SCJP Certification: A Comprehensive Primer, 3/e, ISBN: 0321556054*

Course Code	Course Title	L	T	P	C
MCA 204	Operating System	4	0	0	4
Total Contact hours	40				
Pre-Requisites	Computer system architecture, C++, data structures				
Objectives					
1. To understand overall functionality of Operating System. 2. To Provide sufficient knowledge of operating system design. 3. To understand the impact of operating system on application systems design and performance.					

UNIT I–INTRODUCTION:
Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System, Layered Approach, Introduction to Virtual Machines.

UNIT II–PROCESSES:
Process State, Process Control Block, Process Scheduling, Operation on processes, Co-operating Processes, Threads.

UNIT III-CONCURRENCY AND SCHEDULING:
Principles of Concurrency-Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem. Deadlocks-prevention-avoidance-detection, Scheduling- Basic Concepts of Scheduling,types of scheduling algorithms.

UNIT IV–MEMORY:
Memory management requirements, swapping, memory allocation, Partitioning, Paging and Segmentation, Virtual memory - Demand Paging; Page Replacement algorithm.

UNIT V - INPUT/OUTPUT AND FILE SYSTEMS:
I/O management and disk scheduling – I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache. File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.

Text/ Reference Books:
1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. Andrew S. Tanenbaum, “Modern Operating System”, PHI Learning
3. Tanenbaum /Woodhaull “Operating System Design and Implementation”, Pearson Publication.
4. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education
5. Flynn, “Understanding Operating System” , Cengage.
6. D M Dhamdhere, “Operating Systems : A Concept basedApproach”, McGraw Hill.

7. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".
8. Stuart E. Madnick& John J. Donovan.Operating Systems.McGraw Hill.
9. A. K. Sharma, "Operating System", University Press.
10. Achyut S Godbole, Atul kahate , "Operating System", McGraw Hill

Outcomes
After completion of course, students would be able to:
• Familiarize with the fundamental concepts of operating systems. • Understand relation between various applications and operating system.

MCA PE111 Artificial Intelligence

Course Objectives:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes (COs):

At the end of the course, student will be able to

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

UNIT-I: Introduction to artificial intelligence:

Introduction , history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, Problem solving: state-space search

and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction.

UNIT-II: Problem reduction and game playing:

Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games, Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT-III: Knowledge representation:

Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web, Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

UNIT-IV: Uncertainty measure: Probability theory:

Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory , Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

UNIT-V: Machine learning paradigms:

Introduction, machine learning systems, supervised and unsupervised learnings, inductive learning, deductive learning, clustering, support vector machines, case based reasoning and learning, Artificial neural networks: Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks.

Readings

1. A.M. Andrew, Artificial Intelligence. Kent: Abacus Press, 1983.

2. R., Grishman, Computational Linguistics, Cambridge: Cambridge University Press, 1986.

3. G. Keith, and M. Glover, Primary Language Learning with Microcomputers. London: Croom Helm, 1987. 23

4. S. Nirenburg, (ed) Machine Translation: I Theoretical and Methodological Issues. Cambridge, Cambridge University Press, 1987.

5. W.A. Sedlow, and S.Y. Sedlow, (eds.) Computer in Language Research, Hillsdale: N.S. Lawrence Erlbawn, 1979.

MCA PE221 Data Science and Analytics

Course Objectives/Course Description

- To provide strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science.

Learning Outcome

- CO1: Understand the fundamental concepts of data science
- CO2: Evaluate the data analysis techniques for applications handling large data
- CO3: Demonstrate the various machine learning algorithms used in data science process
- CO4: Understand the ethical practices of data science
- CO4:Visualize and present the inference using various tools
- CO5:Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making

Unit-1 INTRODUCTION TO DATA SCIENCE

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

Unit-2 BIG DATA AND ANALYTICS

Problems when handling large data – General techniques for handling large data through data analytics – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

Unit-3 MACHINE LEARNING

Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

Unit-4 DEEP LEARNING

Introduction – Deep Feedforward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

Unit-5 DATA VISUALIZATION ETHICS AND RECENT TRENDS

Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary. Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Text Books and Reference Books:

[1]. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

[2]. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

[3]. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016

[4]. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Essential Reading / Recommended Reading

[1]. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015

[2]. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013

[3]. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014

MCA 205 Data Structures Lab

MCA 206 Java Programming Lab

MCA 301 (FORMAL LANGUAGES AND COMPILER DESIGN)

Unit – I

INTRODUCTION: Introduction to Translators (interpreter, compiler & cross-compiler), Phases of compilation and overview, Introduction to GCC.

LEXICAL ANALYSIS (SCANNER): Regular language, finite automata, regular expression and their applications to lexical analysis, from regular expression to finite automata, Implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, ambiguity, YACC.

Unit – II

SYNTAX ANALYSIS (PARSER): Context-free language and grammar

BASIC PARSING TECHNIQUES: Parsers, Top-down parsing, Shift reduce parsing, operator grammar, operator precedence parsing, predictive parsers. LL(1) grammar, LR(0), SLR(1), LR(1), LALR(1) grammars and Bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc,bison).

Unit – III

SYNTAX-DIRECTED TRANSLATION: Syntax-directed Translation schemes, Implementation ofSyntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser.

Unit – IV

SEMANTIC ANALYSIS: Attribute grammar, syntax directed definition, evaluation and flow of attribute in a syntax tree.

SYMBOL TABLE: Data structure for symbols tables, representing scope information, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit – V

INTERMEDIATE CODE GENERATION: Translation of different language features, different types of intermediate codes.

CODE IMPROVEMENT (OPTIMIZATION): Analysis: control-flow, data-flow dependence etc., Code improvement local optimization, global optimization, loop optimization, peep-hole optimization

TEXTBOOKS

- *Alfred V. Aho, Monica S. Lam, Ravi Sethi & Jeffrey D. Ullman, Compilers: Principles,Techniques, and Tools, 2nd edition, Prentice Hall, 2006.*

REFERENCE BOOKS

- *Allen I. Holub, Compiler Design in C , PHI, 2003.*
- *C. N. Fischer and R. J. LeBlanc, Crafting a compiler with C, Benjamin Cummings, 2003.*
- *J.P. Bennet, Introduction to Compiler Techniques, 2nd Edition, TMH, 2003.*
- *Henk Alblas and Albert Nymeyer, Practice and Principles of Compiler Building with C,PHI, 2001.*

MCA 302 Machine Learning

Course Prerequisite:
Total Teaching Hours: 48 hours
Course Objective:
 To learn the concept of how to learn patterns and concepts from data without being
explicitly programmed in various IoT nodes.
 To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
 Explore supervised and unsupervised learning paradigms of machine learning.
 To explore Deep learning technique and various feature extraction strategies..

Unit wise Syllabus

Unit – I: Supervised Learning
Supervised Learning (Regression/Classification) - Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes - Linear models: Linear Regression, Logistic Regression, Generalized Linear Models; Support Vector Machines, Nonlinearity and Kernel Methods; Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.
Unit – II: Clustering

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Clustering: K-means/Kernel K-means; Dimensionality Reduction: PCA and kernel PCA; Matrix Factorization and Matrix Completion; Generative Models (mixture models and latent factor models).
Unit – III: Evaluating Machine Learning
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).
Unit – IV: Sparse Modeling & Estimation
Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning
Unit – V: Scalable Machine Learning
Scalable Machine Learning (Online and Distributed Learning A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.
Unit – VI: Recent Trends in various learning technique
Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.
Learning Outcome:
After completion of course, students would be able to:
 Extract features that can be used for a particular machine learning approach in

various IOT applications.
 To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
 To mathematically analyse various machine learning approaches and paradigms.

Text/ Reference Books:

 Tom M. Michell, Machine Learning, McGraw Hills
 AurÈlien GÈron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, Orielly Publications
 Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
 Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
 Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

MCA 303 Data Warehousing and Data Mining

COURSE OVERVIEW:
This course helps the students to understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing using OLAP tools. The different data mining models and techniques will be discussed in this course. Data mining and data warehousing applications in bioinformatics will also be explored.
COURSE OBJECTIVES:
1. To teach the basic principles, concepts and applications of data warehousing and data mining 2. To introduce the task of data mining as an important phase of knowledge recovery process 3. To familiarize Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment 4. To impart knowledge of the fundamental concepts that provide the foundation of data mining COURSE OUTCOMES: After undergoing the course, Students will be able to understand 1. Design a data mart or data warehouse for any organization 2. Develop skills to write queries using DMQL 3. Extract knowledge using data mining techniques 4. Adapt to new data mining tools. 5. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
UNIT - I INTRODUCTION TO DATA MINING: Motivation, Importance, Definition of Data Mining, Kind of Data,Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Database or Data Warehouse System, Major Issues In Data Mining, Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity. PREPROCESSING: Data Quality, Major Tasks in Data Preprocessing, Data Reduction, DataTransformation and Data Discretization, Data Cleaning and Data Integration.
UNIT - II DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING: Data Warehouse basicconcepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction. DATA CUBE TECHNOLOGY: Efficient Methods for Data Cube Computation, Exploration andDiscovery in Multidimensional Databases.
UNIT - III MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Are All the Pattern Interesting, Pattern Evaluation Methods, Applications of frequent pattern and associations. FREQUENT PATTERN AND ASSOCIATION MINING: A Road Map, Mining Various Kinds ofAssociation Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns.
UNIT - IV CLASSIFICATION: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Classification, Bayesian Belief
UNIT - V CLUSTER ANALYSIS: Basic Concepts of Cluster Analysis, Clustering structures, Major ClusteringApproaches, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model Based Clustering - The Expectation-Maximization Method, Other Clustering Techniques, Clustering High-Dimensional Data, Constraint-Based and User-Guided Cluster Analysis, Link-Based Cluster Analysis, Semi-Supervised Clustering and Classification, Bi-Clustering, Collaborative Clustering. OUTLIER ANALYSIS: Why outlier analysis, Identifying

and handling of outliers, Distribution BasedOutlier Detection: A Statistics-Based Approach, Classification-Based Outlier Detection, Clustering-Based Outlier Detection, Deviation-Based Outlier Detection, Isolation-Based Method: From Isolation Tree to Isolation Forest.

TEXT BOOKS: 1. Jiawei Han, MichelineKamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3 rdedition, Elsevier, United States of America. REFERENCE BOOKS: 1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2ndedition,Pearson Education, New Delhi, India. 2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India. 3. Xingdong Wu, Vipin Kumar (2009), the Top Ten Algorithms in Data Mining, CRC Press, UK

MCA SEE312 Linux and Unix Programming

Course Overview: This course explains the fundamental ideas behind the open source operating system approach to programming. Knowledge of Linux helps to understand OS level programming. Like the successful computer languages that came before, Linux is the blend of the best elements of its rich heritage combined with the innovative concepts required by its unique environment. This course involves kernel concepts, basics commands, shell scripting, file processing ,Socket programming ,Processes, Inter process communication. This course is presented to students by power point projections, course handouts, lecture notes, assignments, objective and subjective tests

Course Objectives: 1. To teach principles of operating system including File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking Commands, Basic Linux commands, Scripts and filters. 2. To familiarize fundamentals of the Bourne again shell (bash), shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts. 3. To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's). 4. To facilitate students in understanding Inter process communication. 5. To facilitate students in understanding semaphore and shared memory. 6. To facilitate students in understanding process. Course Outcomes: 1. Ability to use various Linux commands that are used to manipulate system operations at admin level and a prerequisite to pursue job as a Network administrator. 2. Ability to write Shell Programming using Linux commands. 3. Ability to design and write application to manipulate internal kernel level Linux File System. 4. Ability to develop IPC-API's that can be used to control various processes for synchronization. 5. Ability to develop Network Programming that allows applications to make efficient use of resources available on different machines in a network.

UNIT – I INTRODUCTION TO LINUX AND LINUX UTILITIES: A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

UNIT - II Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT - III Grep: Operation, grep Family, Searching for File Content. Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed. UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers. File Management :File Structures, System Calls for File Management – create, open, close, read,

write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask.

UNIT - IV PROCESS AND SIGNALS: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.

UNIT - V INTER PROCESS COMMUNICATION: Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands. INTRODUCTION TO SOCKETS: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.

TEXT BOOKS: 1. W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India. 2. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg.Thomson REFERENCES: 1. Linux System Programming, Robert Love, O'Reilly, SPD. 2. Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education. 3. UNIX Network Programming, W.R. Stevens, PHI. UNIX for Programmers and Users, 3rd Edition, Graham Glass, King Ables, Pearson Educatio

MCA PE331 (DISTRIBUTED SYSTEMS)

Objectives

1. Present the principles underlying the function of distributed systems and their extension to grid and cloud computing and virtualization techniques
2. Create an awareness of the fundamental technical challenges in advanced distributed systems design and implementation;
3. Expose students to current technology used to build architectures to enhance distributed computing infrastructures with various computing principles and paradigms, including grid and cloud computing;
4. Enhance students' understanding of key issues related to multi-level interoperability across a distributed infrastructure and across multiple heterogeneous and distributed resources in a dynamically changing computing environment;
5. Expose students to past and current research issues in the field of distributed systems and new challenges in cloud computing; and
6. Provide experience in analyzing a distributed computing model and implementing typical algorithms used in distributed systems and distributed applications in cloud infrastructure.

Unit – I

CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges.
SYSTEM MODELS: Architectural models, Fundamental Models,

THEORETICAL FOUNDATION FOR DISTRIBUTED SYSTEM: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection.

DISTRIBUTED MUTUAL EXCLUSION: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non-token based algorithms, performance metric for distributed mutual exclusion algorithms.

Unit – II

DISTRIBUTED DEADLOCK DETECTION: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.

AGREEMENT PROTOCOLS: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem,

Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system

Unit – III

Distributed Objects and Remote Invocation: Communication between distributed objects, Remote procedure call, Events and notifications.
Security: Overview of security techniques, Cryptographic algorithms, Digital signatures.
Distributed File Systems: File service architecture.

Unit – IV

TRANSACTIONS AND CONCURRENCY CONTROL: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.
DISTRIBUTED TRANSACTIONS: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.
Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Unit – V

DISTRIBUTED ALGORITHMS: Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, Deadlock free Packet switching, Election algorithm.

TEXTBOOKS

- *Singhal & Shivaratri, Advanced Concept in Operating Systems, McGraw Hill.*
- *Coulouris, Dollimore, & Kindberg, Distributed System: Concepts and Design, Pearson.*

REFERENCE BOOKS

- *Gerald Tel, Distributed Algorithms, Cambridge University Press.*

Learning outcome

1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;
2. Demonstrate knowledge of the core architectural aspects of distributed systems;
3. Design and implement distributed applications;
4. demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);
5. Demonstrate experience in building large-scale distributed applications.

MCA OE312 (Cyber-Physical Systems and IoT)

Unit I

Introduction to IoT – Definition of IoT. Why use IoT. Importance of IoT. Web 3.0. Ubiquitous Computing and IoT. Applications of IoT. Privacy and Security issues. Pillars of IoT - Horizontal, Verticals, and Four Pillars, The internet of devices, objects, transducers, and controllers.

Unit II

Web of Things vs. Internet of Things. IoT Standardization. Standardization protocols. Issues with IoT Standardization. Cloud Computing. Cloud of Things. IoT vs Cloud Computing

Unit III

Introduction to CPS – Definition of CPS. Key features of cyber physical systems. CPS in real world. CPS Architecture and CPS Ecosystem. Applications of CPS.

Unit IV

Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS. Security in CPS.

Unit V

Cyber-Physical Systems (CPS) in the real world. Applications of Cyber-Physical Systems: Overview of CPS applications. Examples of systems, Smart City, Power grid control, monitoring applications etc.

MCA 304	ML Lab
MCA 305	Lab based on SEE

MCA PE334
MOOCS (ACADEMIC WRITING) (PE-3)
INSTRUCTOR: DR AJAY SEMALTY

Course layout: Academic Writing

Course Duration 15 week

Credits : 04

Week 1

Academic & research writing: Introduction; Importance of academic writing; Basic rules of academic writing

Week 2

English in academic writing I & II; Styles of research writing

Week 3

Plagiarism: Introduction; Tools for the detection of plagiarism; Avoiding plagiarism

Week 4

Journal Metrics

Week 5

Author Metrics

Week 6

Literature review: Introduction, Source of literature; Process of literature review

Week 7

Online literature databases; Literature management tools

Week 8

Review Paper Writing, I & II

Week 9

Research paper writing I, II, III

Week 10

Referencing and citation; Submission and; Post submission

Week 11

Thesis Writing I, II & III

Week 12

Empirical Study I, II & III

Week 13

Challenges in Indian research & writing; Team management (mentor and collaborators); Time Management

Week 14

Research proposal writing; Abstract/ Conference Paper/ Book/ Book Chapter writing; OERs: basic concept and licenses

Week 15

Open Educational Resources (OERs) for learning & Research; OERs development I & II