

PET - 2024

SYLLABUS

Faculty-Commerce and Management Science

***Subject - Computer Application
(MCA in Management Science)***



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Section - A

Syllabus Paper – I Research Methodology

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process.
2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a Good Hypothesis – Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance
3. Research Design : Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.
4. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.
5. Measurement : Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.
6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.
7. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.
8. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

Section - B

UNIT I

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs, Sorting and Searching Algorithms; Hashing.

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

UNIT II

Programming in C: Elements of C-Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration(s), Structured data types in C arrays, struct, union, string and pointers

O-O Programming Concepts: Class, object, instantiation, Inheritance, polymorphism and overloading.

C++ Programming: Elements of C++-Tokens, identifiers, Variables and constants, Data types, Operators, Control statements, Functions parameter passing, Class and objects, Constructors and destructors, Overloading, Inheritance, Templates, Exception handling.

Object, messages, classes, encapsulation, inheritance, polymorphism aggregation, abstract classes generalization as extension and restriction, Object oriented design. Multiple inheritance, metadata.

JAVA: Introduction to Java Programming, Java - Programming Fundamentals, Classes and Objects, Inheritance & Polymorphism, Exception Handling, Threading, Java I/O, Event Programming, Java, Servlets, Applets.

HTML, DHTML, XML, Scripting,

Getting Started with Python: Python, Python Operators, Python Data Types, Conditional Statement in Python, Loops in Python: , Reading and writing files with Python; Functions in Python, Python OOPs Concepts, Python Libraries for Data Analysis, Python Libraries for Data Visualization

Database System Concepts and Architecture: Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model - Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus; Codd Rules.

SQL: Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

Normalization for Relational Databases: Functional Dependencies and Normalization; Algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; Database Security and Authorization.

UNIT III

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers.

Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot.

Process Management: Process Scheduling and Operations; Interprocess Communication, Communication in Client-Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple- Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

Storage Management: Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.

File and Input/Output Systems

Security: Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses.

Virtual Machines: Types of Virtual Machines and Implementations; Virtualization.

Linux Operating Systems: Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Distributed Systems: Types of Network based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

Network fundamentals : Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks.

Reference Models : The OSI model, TCP/IP model.

Data Communication : Channel capacity, Transmission Media-twisted pair, coaxial cables, fibre-optic cables, wireless transmission-radio, microwave infrared and millimeter

waves. Lightwave transmission, Telephones-local loop, trunks, multiplexing, switching, narrowband
ISDN, broadband ISDN, ATM, High speed LANS, Cellular Radio. Communication satellites-geosynchronous and low-orbit.
Internetworking : Switch/Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls.
Routing : Virtual circuits and datagrams, Routing algorithms, Congestion control.
Network Security : Cryptography-public key, secret key, Domain Name System (DNS)-Electronic Mail and Worldwide Web (WWW), The DNS, Resource Records, Name servers, E-mail architecture and Serves.
Analog and Digital transmission, Asynchronous and Synchronous transmission, Transmission media, Multiplexing and Concentration, Switching techniques, Polling.
TCP/IP protocols suite, Networks security, Network administration

UNIT IV

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.
Knowledge Representation: Logic, Semantic Networks, Frames, Rules, Scripts, Conceptual Dependency and Ontologies; Expert Systems, Handling Uncertainty in Knowledge.
Planning: Components of a Planning System, Linear and Non Linear Planning; Goal Stack Planning, Hierarchical Planning, STRIPS, Partial Order Planning.
Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Pragmatics.
Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.
Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

UNIT V

Software Process Models: Software Process, Generic Process Model – Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models
Software Requirements: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirement and Specification (SRS) Document.
Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.
Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability.
Estimation and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations;

Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

MIS, Decision Making: An overview: Concept, definition, characteristics, objectives, Role and impact of MIS, Management as a control system, MIS: A support to the management, application of MIS to e- business, organization effectiveness, Decision making concept, decision making process, organizational decision making, MIS and decision making.

Information, Knowledge, Business Intelligence: Information: A quality product, Classification of information, methods of data and information collection, value of information, IT infrastructure, components, Planning, contemporary platforms, IT Capabilities and their organizational impact – Telecommunication, Networks & internet, current trends in technologies & tools -- IT enabled services, e business, wireless technologies etc.

Information systems levels, information system in business, Computer based information system, limitation and disadvantages of IS, Human as an information processor, knowledge and knowledge management system, business intelligence.

System Engineering: Analysis and design, BPR: System: concept and control, types of system, general model of MIS, need of system Analysis, SDM, SSAD, OOA, OOSAD Development Life cycle, development process of MIS, Strategic design of MIS, Business process, Process model of an organization, MIS and BPR

DSS, ESS, OAS: DSS: concept and philosophy, objectives and characteristics of DSS, major functions of DSS, Components of DSS, DSS generators and tools, limitations of DSS, GDSS, components of GDSS, MIS and benefits of DSS, ESS and components of ESS, OAS, EMS, teleconferencing, telecommuting, automated office, off- line and online data processing

Knowledge system, artificial intelligence and ERP: Knowledge system, types of knowledge system, Expert system, application of ES, benefits and Limitations of ES, knowledge base, inference engine, AI, neural network in business, SIS, EMS, ERP, ERP models and modules, benefits of ERP, ERP implementation, SCM, CRM.