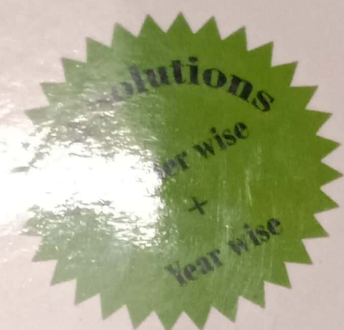


By Professors of MAKAUT Affiliated Colleges




Moulana Abul Kalam Azad University of Technology

# MAKAUT (Formerly WBUT) **organizer** EXAMINATION GUIDE

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**B. TECH  
COMPUTER SCIENCE  
6th (SIXTH) SEMESTER**

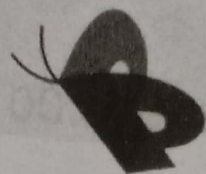
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## COMPUTER SCIENCE

6<sup>th</sup> (Sixth) Semester

[According to New MAKAUT Syllabus]



smart approach

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# Syllabus

## DATABASE MANAGEMENT SYSTEMS [PCC-CS 601]

### Unit 1:

**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

**Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

### Unit 2:

**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

**Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

**Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

### Unit 3:

**Storage strategies:** Indices, B-trees, hashing.

### Unit 4:

**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multiversion and optimistic Concurrency Control schemes, Database recovery.

### Unit 5:

**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

### Unit 6:

**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

## COMPUTER NETWORKS [PCC-CS 602]

### Unit 1:

**Data communication Components:** Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media,

**LAN:** Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

### Unit 2:

**Data Link Layer and Medium Access Sub Layer:** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back - N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

### Unit 3:

**Network Layer:** Switching, Logical addressing - IPV4, IPV6; Address mapping - ARP, RARP, BOOTP and DHCP-Delivery, Forwarding and Unicast Routing protocols.

### Unit 4:

**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

### Unit 5:

**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

## ADVANCED ALGORITHMS [PEC-IT 601A]

### Unit 1:

**Sorting:** Review of various sorting algorithms, topological sorting

**Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.



## Unit 2:

**Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

**Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

**Flow-Networks:** Maxflow-mincut theorem, FordFulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

**Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

## Unit 3:

**Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

**Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

**Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

## Unit 4:

**Linear Programming:** Geometry of the feasibility region and Simplex algorithm.

**NP-completeness:** Examples, proof of NP-hardness and NP-completeness.

**One or more of the following topics based on time and interest:** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

## Unit 5:

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

## DISTRIBUTED DATABASE MANAGEMENT SYSTEM [PEC-IT 601B]

### Unit 1:

**Introduction:** Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

**Distributed Database Management System Architecture:** Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

### Unit 2:

**Distributed Database Design:** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation

**Semantics Data Control:** View management; Data security; Semantic Integrity Control QUERY

**Processing Issues:** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data

### Unit 3:

**Distributed Query Optimization:** Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms

**Transaction Management:** The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models

**Concurrency Control:** Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

### Unit 4:

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm

### Unit 5:

**Parallel Database Systems:** Parallel architectures; parallel query processing

### Unit 6:

**Advanced Topics:** Mobile Databases, Distributed Object Management, Multi-databases

## IMAGE PROCESSING [PEC-IT 601D]

### Unit 1:

**Introduction:** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

### Unit 2:

**Digital Image Formation:** A Simple Image Model, Geometric Model - Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.



### Unit 3:

**Mathematical Preliminaries:** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of the Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

### Unit 4:

**Image Enhancement:** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening, Highpass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

### Unit 5:

**Image Restoration:** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

### Unit 6:

#### **Image Segmentation:**

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

## **DATA WAREHOUSING AND DATA MINING [PEC-IT 602B]**

### Unit 1:

Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;

### Unit 2:

Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

### Unit 3:

Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;

### Unit 4:

Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis; modulation for communication, filtering, feedback control systems.

### Unit 5:

Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

### Unit 6:

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis.

## **PATTERN RECOGNITION [PEC-IT602D]**

### Unit 1:

Basics of pattern recognition.

### Unit 2:

**Bayesian decision theory:** Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions Discrete features.

### Unit 3:

**Parameter estimation methods:** Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation.

### Unit 4:

**Hidden Markov models for sequential pattern classification:** Discrete hidden Markov models Continuous density hidden Markov models.

### Unit 5:

#### **Dimension reduction methods**

5.1. Fisher discriminant analysis

5.2. Principal component analysis



Parzen-window method.

K-Nearest Neighbour method.

**Unit 6:**

Non-parametric techniques for density estimation.

**Unit 7:**

**Linear discriminant function based classifier**

Perceptron Support vector machines.

**Unit 8:**

**Non-metric methods for pattern classification**

Non-numeric data or nominal data Decision trees.

**Unit 9:**

**Unsupervised learning and clustering**

Criterion functions for clustering

Algorithms for clustering: K-means,

Hierarchical and other methods

### NUMERICAL METHODS [OEC-IT601A]

**Unit 1:**

**Approximation in numerical computation:** Truncation and rounding errors, Fixed and floating point arithmetic, Propagation of errors.

**Unit 2:**

**Interpolation:** Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.

**Unit 3:**

**Numerical integration:** Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

**Unit 4:**

**Numerical solution of a system of linear equations:** Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

**Unit 5:**

**Numerical solution of Algebraic equation:** Bisection method, Regula-Falsi method, Newton-Raphson method.

**Unit 6:**

**Numerical solution of ordinary differential equation:** Euler's method, Runge-Kutta methods, Predictor Corrector methods and Finite Difference method.

### HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOUR [OEC-IT 601B]

**Unit 1:**

**Organizational Behaviour:** Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.

**Personality and Attitudes:** Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.

**Unit 2:**

**Perception:** Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.

**Motivation:** Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.

**Unit 3:**

**Group Behaviour:** Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making

**Communication:** Communication Process, Direction of Communication, Barriers to Effective Communication.

**Leadership:** Definition, Importance, Theories of Leadership Styles.

**Unit 4:**

**Organizational Politics:** Definition, Factors contributing to Political Behaviour.

**Conflict Management:** Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation - Bargaining Strategies, Negotiation Process.

**Organizational Design:** Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.

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