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M.Sc. (COMPUTER SCIENCE)
Session 2019-2020

Year	Semester	Paper Code	Title of Paper
First Year	I	CS 101	Operating System
		CS 102	Discrete Mathematics
		CS 103	Theory of Computation
		CS 104	Advanced Database Management Systems
		CS 105	Lab (ADBMS)
	II	CS 201	Compiler Design
		CS 202	Design and Analysis of Algorithms
		CS 203	Advance Computer Network
		CS 204	Software Engineering
		CS 205	LAB (DAA)

CS 101: Operating System

UNIT I

Introduction: Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls, OS structure: Layered, Monolithic, Microkernel Operating Systems – Concept of Virtual Machine.

UNIT II

Process Management: Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads – Concept of multithreads.
Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only), Scheduling algorithms: Pre-emptive and Non, pre-emptive, FCFS – SJF – RR, Multiprocessor scheduling: Types, Performance evaluation of the scheduling.

UNIT III

Inter-process Communication: Race Conditions, Critical Section, Mutual Exclusion, Peterson's Solution, The Producer Consumer Problem, Semaphores, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.
Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.

UNIT V

Memory Management: Basic Memory Management: Definition, Logical and Physical address map , Memory allocation : Contiguous Memory allocation, Fixed and variable partition, Internal and External fragmentation and Compaction , Paging : Principle of operation, Page allocation, Hardware support for paging, Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit, Demand paging (Concepts only), Page Replacement policies : Optimal (OPT), First in First Out (FIFO, Least Recently used (LRU).

UNIT V

I/O Management & Disk Scheduling: I/O Devices and the Organization of I/O Disk I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

Recommended Books:
1. Stalling, Willium, "Operating System", Maxwell Macmillan
2. Silveschatza, Peterson J, "Operating System Concepts", Willey.
3. A Silberschatz, P B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
4. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.

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CS 102: Discrete Mathematics

Unit I
Propositional Logic: Propositions, Logical connectives, Compound propositions, Conditional and biconditional propositions, Truth tables, Tautologies and contradictions, Contrapositive, Logical equivalences and implications, DeMorgan's Laws, Normal forms, Principal conjunctive and disjunctive normal forms, Rules of inference, Arguments, Validity of arguments.

Unit II
Predicate Calculus: Predicates, Statement function, Variables, Free and bound variables, Quantifiers, Universe of discourse, Logical equivalences and implications for quantified statements, Theory of inference, The rules of universal specification and generalization, Validity of arguments.

Unit III
Set Theory: Basic concepts, Notations, Subset, Algebra of sets, The power set, Ordered pairs and Cartesian product, Relations on sets, Types of relations and their properties, Relational matrix and the graph of a relation, Partitions, Equivalence relations, Partial ordering, Poset, Hasse diagram, Lattices and their properties, Sublattices, Boolean algebra, Homomorphism.

Unit IV
Functions: Definitions of functions, Classification of functions, Type of functions, Examples, Composition of functions, Inverse functions, Binary and n-ary operations, Characteristic function of a set, Hashing functions, Recursive functions, Permutation functions.

Unit V
Groups: Algebraic systems, Definitions, Examples, Properties, Semigroups, Monoids, Homomorphism, Sub semigroups and Submonoids, Cosets and Lagrange's theorem, Normal subgroups, Normal algebraic system with two binary operations, Codes and group codes, Basic notions of error correction, Error recovery in group codes.

Recommended Books:

1. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd,
2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia,

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CS 103: Theory of Computation

Unit I

Introduction to defining language, Kleene closures, Arithmetic expressions, defining grammar, Chomsky hierarchy, Finite Automata (FA), Transition graph, generalized transition graph.

Unit II

(Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, FA with output: Moore machine, Mealy machine and Equivalence, Applications and Limitation of FA.

Unit III

Arden Theorem, Pumping Lemma for regular expressions, Myhill-Nerode theorem, Context free grammar: Ambiguity, Simplification of CFGs, Normal forms for CFGs, Pumping lemma for CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG.

Unit IV

Push Down Automata (PDA): Description and definition, Working of PDA, Acceptance of a string by PDA, PDA and CFG, Introduction to auxiliary PDA and Two stack PDA.

Unit V

Turing machines (TM): Basic model, definition and representation, Language acceptance by TM, TM and Type – 0 grammar, Halting problem of TM, Modifications in TM, Universal TM, Properties of recursive and recursively enumerable languages, unsolvable decision problem, undecidability of Post correspondence problem, Church's Thesis, Recursive function theory

Recommended Books:
1. Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House, 3rd Edition

2. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI, 3rd Edition

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CS 104: Advanced Database Systems

Unit I

Introduction: An overview of Database systems, Architecture, Schema and Instances, Data Independence and Data Base. Entity-Relationship Diagram, generalization, aggregation and association, Data Models: Hierarchical, Network and Relational.

Unit II

Relational data model concepts, Integrity constraints, keys, Domain Constraints, Referential Integrity, Assertions, Triggers, Foreign key, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Reduction of Relation Algebra to Relational Calculus, Relation Completeness.

Unit III

Functional Dependencies, normal forms (1NF, 2NF, 3NF), BCNF, Multivalued Dependencies, 4NF, Join Dependencies and 5NF. Query processing and optimization. Transaction processing concepts.

Unit IV

Transaction systems, schedule and recoverability, Testing of serializability, Serializability of schedules, conflicts. Concurrency control techniques: Locking techniques for concurrency control, Time stamping protocols validation techniques, multiple granularity, multiversion schemes.

Unit V

Distributed database: Distributed data storage, data fragmentation, replication and allocation techniques for distributed database design, recovery in distributed database, protection and security.

Recommended Books:
1. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Education.
2. Korth, Silbertz, Sudarshan," Database Concepts" McGraw Hill
3. C.J. Date, "An Introduction to Database Systems" Addision Wesley
4. Bipin C. Desai," An Introduction to Database Systems", Galgotia Publication
5. Mazumdar and Bhattacharya, "Database Management Systems", TMH
6. Ramakrishnan, Gehrke, " Database Management System", McGraw Hill

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CS 201: Compiler Design

UNIT I

INTRODUCTION TO COMPILERS: Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics

UNIT II

LEXICAL ANALYSIS: Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analysers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III

SYNTAX ANALYSIS: Need and Role of the Parser-Context Free Grammars -Top Down Parsing - General Strategies-Recursive Descent Parser Predictive Parser-LL (1) Parser-Shift Reduce Parser-LR Parser-LR (0) Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer

UNIT IV

SYNTAX DIRECTED TRANSLATION RUN TIME ENVIRONMENT: syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions. RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables-Dynamic Storage Allocation

UNIT V

CODE OPTIMIZATION AND CODE GENERATION: Principal Sources of Optimization-DAG-Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm

Recommended Books:
1. Aho, Sethi & Ullman, "Compiler Design", Addision Wesley/ Pearson.
2. O. G. Kakde; Compiler Design,4/e; Universities Press (2008)
3. Chattopadhyay Santanu; Compiler Design; Phi Learning (2009)

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CS 202: Design and Analysis of Algorithms

Unit I
Algorithms, Analysis of Algorithm, Design of Algorithms, Time and space complexities, Asymptotic notations, Growth+ of Functions, Recurrences. Sorting in Polynomial Time: Insertion Sort, Merge Sort, Heap sort and Quick Sort. Sorting in Linear Time: Counting Sort, Radix Sort, Bucket Sort

Unit II
Elementary Data Structure: Stacks, Queues, Linked List, Binary Search Tree, Hash Table, Red Black Trees, AVL Tree, Splay Tree, Augmenting Data Structure Advanced Data Structure: Binomial Heap, B-tree, Fibonacci Heap, and Data Structure for Disjoint sets.

Unit III
Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch- and- Bound. Huffman Coding.

Unit IV
Graph Algorithms: Elementary Graph Algorithm, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path, All Pair Shortest Path, Maximum Flow and Travelling Salesman Problem.

Unit V
Randomized Algorithm: String Matching, NP-Hard and NP- Completeness, Approximation Algorithms.

Recommended Books:
1. Horowitz Sahni, "Fundamentals of Computer Algorithm", Galgotia,
2. Coreman Leiserson etal, "Introduction to Algorithm", PHI
3. Brassard Bratley, "Fundamental of Algorithm", PHI
4. M.T. Goodrich etal, "Algorithms Design", John Wiley and Sons
5. A V. Aho etal, "The Design and Analysis of Algorithms", Pearson Education

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CS 203: ADVANCEDCOMPUTER NETWORKS

Unit I

Introduction: Overview of computer network, seven-layer architecture, TCP/IP suite of protocol, etc. Mac protocols for high-speed LANS, MANs& WIRELESS LANs. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet etc.) Fast access technologies. (For example, ADSL, Cable Modem, etc.)

Unit II

IPv6: why IPv6, basic protocol, extension & option, support for QoS, security, etc, neighbour discovery, auto-configuration, routing. Change to other protocols. Application programming interface forIPv6. 6bone.

Unit III

Mobility in network. Mobile. Security related issues. IP Multicasting. Multicasting routing protocols, address assignments, session discovery, etc. TCP extensions for high-speed networks, transaction-oriented application, other new options in TCP.

Unit IV

 Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Key distribution protocols. Digital signatures, digital certificates.

Unit V

Study of complete network architecture of your institution (including topology, network devices cabling standards, protocol and security features). Hands on experiment for configuring network interface card for connecting two systems. Test the connectivity between two hosts. Test all options of ping.

Recommended Books:
1. 1.W. R. Stevens,"TCP/IPillustrated,Volume1:The protocols",Addison Wesley 1994.
2. 2.G.R. Wright. "TCP/IPillustrated, Volume2: The implementation", Addison Wesley 1995

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CS 204: Software Engineering

Unit I

Introduction**:** Software Engineering vs. Traditional Programming, System Development Life Cycle (Software Production Process, Conception, Initiation, Analysis Design, Construction, Testing, Implementation). Waterfall Model, Evolutionary Model. Factors affecting Software Development and Maintenance.

Unit II

Software Project Management: Defining the Problem, developing a Solution Strategy, Planning the Development Process, Measurement of Software Productivity and Quality.

Unit III

Software Engineering Principles &Tools: Tools of Design (Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables), Modularization (Coupling)

Unit IV

Testing: Testing fundamentals, Unit testing, Blackbox testing, Whitebox testing, Basic Path testing, Control Structure testing, Integration testing.

Unit V

Software maintenance: Introduction to Software Maintenance, Enhancing Maintainability During Development (analysis Activities, Standards and Guidelines, Design activities, Implementation Activities, Supporting Documents) Managerial Aspects of Software Maintenance (Change Control Board, Change Request summaries, Quality Assurance Activities, Organizing Maintenance Programs).

Recommended Books:
1. R.F.Fairley,, "Software Engineering Concepts", McGraw Hill.
2. R.S.Press Man , "Software Engineering A Practitioners Approach" McGraw Hill.
3. Rajib Mall, "Fundamentals of Software Engineering". PHI.
4. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa