AKU B.E./B.Tech CSE Sem 4 syllabus

Operating System

Module 1
Introduction: Concept of Operating Systems, Generations of Operating systems, Types of
Operating Systems, OS Services, System Calls, Structure of an OS- Layered, Monolithic,
Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS
Operating System.
Module 2
Processes: Definition, Process Relationship, Different states of a Process, Process State transitions,
Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads
Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria:
CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling
algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time
scheduling: RM and EDF.
Module 3
Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware
Solution, Strict Alternation, Peterson’s Solution, The Producer - Consumer Problem, Semaphores,
Event Counters, Monitors, Message Passing, Shared Memory, Classical IPC Problems: Reader’s &
Writer Problem, Dinning Philosopher Problem etc.
Module 4
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock,

Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and
Recovery.

Module 5

Memory Management: Basic concept, Logical and Physical address map, Memory allocation:
Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and
Compaction; Paging and Segmentation: Principle of operation – Page allocation – Hardware support
for paging, Protection and sharing, Advantages and Disadvantages of paging and segmentation.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of
reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement
algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and
Least Recently used (LRU).

Module 6

File Management: Concept of File, Access methods, File types, File operation, Directory
structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space
management (bit vector, linked list, grouping), directory implementation (linear list, hash table),
efficiency and performance.
Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability,

AKU Curriculum for Undergraduate Degree in Computer Science and Engineering

Disk formatting, Boot-block, Bad blocks
I/O Hardware: I/O devices, Device controllers, Direct memory access, Principles of I/O Software:
Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage
Structure.

Discrete Mathematics

PCC-IT301 Discrete Mathematics

4 Credits

Module 1:
Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Module 2:
Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.
Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Module 3:
Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 4:
Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Module 5:
Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and

Hamiltonian Walks, Graph Coloring, Coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw –Hill
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co.Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw –Hill.

Suggested reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMGEdition,TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, MarcLipson,
3. Discrete Mathematics, Tata McGraw -Hill

Digital Electronics

ESC 401 Digital Electronics

5 Credits

Module 1

Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri - state logic.

Module 2

Combinational Digital Circuits: Standard representation for logic functions K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, DeMultiplexer/Decoders, Adders, Subtractors, BCD

arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 3

Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 4

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2RLadder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using Voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

Module 5

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Suggested books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Computer Organization & Architecture

Module 1

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Module 2

Introduction to x86 architecture. CPU control unit design: hardwired and micro- programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB.

Module 3

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Module 4

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. Block size, mapping functions, replacement algorithms, write policies

Design & Analysis of Algorithms

Module 1

Introduction: Characteristics of the algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average, and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters'

theorem.

Module 2
Introduction to Divide and Conquer paradigm: Binary Search, Quick and Merge sorting techniques, linear time selection algorithm, Strassen's Matrix Multiplication, Karatsuba Algorithm for fast multiplication etc. Introduction to Heap: Min and Max Heap, Build Heap, Heap Sort

Module 3
Overview of Brute-Force, Greedy Programming, Dynamic Programming, Branch-and-Bound and Backtracking methodologies. Greedy paradigm examples of exact optimization solution: Minimum Cost Spanning Tree, Knapsack problem, Job Sequencing Problem, Huffman Coding, Single source shortest path problem.
Dynamic Programming, the difference between dynamic programming and divide and conquer, Applications: Fibonacci Series, Matrix Chain Multiplication, 0-1 Knapsack Problem, Longest Common Subsequence, Travelling Salesman Problem, Rod Cutting, Bin Packing.
Heuristics – characteristics and their application domains.

Module 4
Graph and Tree Algorithms: Representational issues in graphs, Traversal algorithms: Depth First Search (DFS) and Breadth-First Search (BFS); Shortest path algorithms: Bellman-Ford algorithm, Dijkstra's algorithm & Analysis of Dijkstra's algorithm using heaps, Floyd-Warshall's all-pairs shortest path algorithm. Transitive closure, Topological sorting, Network Flow Algorithm, Connected Component

Module 5
Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete, and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.Approximation algorithms, Randomized algorithms

Human Resource Development and Organizational Behavior

Module 1

Introduction: HR Role and Functions, Concept and Significance of HR, Changing role of HR managers - HR functions and Global Environment, role of a HR Manager. Human Resources Planning: HR Planning andRecruitment: Planning Process - planning at different levels - Job Analysis

Module 2

Recruitment and selection processes - Restructuring strategies - Recruitment-Sources of Recruitment-Selection Process-Placement and Induction-Retention of Employees. Training and Development: need for skill upgradation - Assessment of training needs - Retraining and Redeployment methods and techniques of training employees and executives – performance appraisal systems.

Module 3

Performance Management System: Definition, Concepts and Ethics-Different methods of Performance Appraisal- Rating Errors Competency management. Industrial Relations : Factors influencing industrial relations - State Interventions and Legal Framework - Role of Trade unions - Collective Bargaining - Workers; participation in management.

Module 4

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.

Module 5

Leadership: Definition, Importance, Theories of Leadership Styles. Organizational Politics:
Definition, Factors contributing to Political Behavior. Conflict Management: Traditional vis-a-vis
Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation -
Bargaining Strategies, Negotiation Process.