JSPM UNIVERSITY

JSPM UNIVERSITY PUNE

SYLLABUS

RPET 2023

Research Program Entrance Test

Computer Science Syllabus

Operating Systems:

Optimal scheduling algorithm, Priority scheduling algorithm, IO processing in OS, Job Scheduling, RR scheduling, Short-term scheduler, Long-term scheduler, Middle-term scheduler, Pre-term scheduler, FIFO scheduling, RMA Working, EDA Algorithm, direct memory access, indirect memory access, Paging in OS, Segmentation in OS, Spooling, Spoofing, Interrupt handling, RPC functioning, Processor allocation, Processor migration, deadlock prevention, deadlock state, non-deadlock state, time execution for the process of transferring information, File system implementation in the operating system.

Computer Organization:

Organization and architecture, structure and function, Computer evolution and performance: Brief history of computer, designing for performance, computer components, computer function, bus interconnection, PCI

External devices, I/O modules, I/O Channels and IOPs, SCSI and firewire interfaces, operating system overview, memory management, swapping, partitioning, paging , virtual memory.

ALU: Machine instruction characteristics , operand types, operation types, Addressing modes, instruction formats, CPU structure, processor organization register organization, instruction cycle, instruction pipelining.

RISC machine, instruction execution characteristics, register file concept, compiler based register optimization, RISC architecture, RISC pipelining, RISC vs CISC, case study of powerPC 620.

Control unit operation: Micro operation, control of processor Hardwired implementation, micro program control: Concepts, microinstructions sequencing and execution, application of microprogramming.

Multiple processor organizations, symmetric multiprocessors, Mainframe SMP, Cache coherence and MESI protocol, clusters, Non uniform memory access, Vector

computation.

Information Systems and Information Retrieval:

Introduction to the database system, Database design, SQL: Queries, Constraints, Database Application Development, Internet Applications, Overview of Storage and Indexing, Storing Data: Disks and Files, Tree-Structured Indexing, Hash-Based Indexing, Overview of Query Evaluation, Evaluating Relational Operators, Concurrency Control, Crash Recovery, Overview of Query Evaluation, Security and Authorization, Parallel and Distributed Databases, Object- Database Systems, Data Warehousing and Decision Support, Data Mining, Information Retrieval and XML Data, Spatial Data Management

Networking:

Concept of layering, OSI layer, LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms, TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP), Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Programming and Data Structure:

Array, Array as ADT, Stack and its operation, Queue and its operation, Priority Queue, Linked List, Types of Linked list, Fundamentals of Tree, Binary Tree, Binary Search Tree, Height Balanced Tree, Weight Balanced Tree, AA Tree, Red Black Tree, Splay Tree.

Computer Graphics

pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics, Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: DDA, Bresenham, and Midpoint, Introduction to polygon, types: convex, concave and complex. Inside test, viewing transformations, 2-D clipping: Cohen – Sutherland algorithm line Clipping algorithm, Sutherland Hodgeman Polygon clipping algorithm, Weiler Atherton Polygon Clipping algorithm ,introduction, homogeneous coordinates, 2-D

transformations - Translation, scaling, rotation and shear, rotation about an arbitrary point,3-D transformations: introduction, 3-D transformations - Translation, scaling, rotation and shear, rotation about an arbitrary axis, Projections : Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric)and Perspective (Vanishing Points – 1 point, 2 point and 3 point),Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Fractal generation: snowflake, Triadic curve, Hilbert curve, Applications

Artificial Intelligence

Introduction to Artificial Intelligence, Foundations of Artificial Intelligence, History of Artificial Intelligence, State of the Art, Risks and Benefits of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agent, Solving Problems by Searching, Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions, Search in Complex Environments, Local Search and Optimization Problems, Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic, First-Order Logic, Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic, Inference in First-Order Logic, Propositional vs. First- Order Inference, Unification and First-Order Inference, Forward Chaining, Backward Chaining, Resolution, Knowledge Representation, Ontological Engineering, Categories and Objects, Events, Mental Objects and Modal Logic, Reasoning Systems for Categories, Reasoning with Default Information.

Programming Languages and Translator

Introduction to PHP , Basic data types and data declarations, scope rule and forward declaration, Data structures: stack, linked list, and tree , Functions and parameter passing , Recursion: concept and programming , Concept of object-oriented programming , Function and operator overloading , Scope of variables Arithmetic operations , Recursion and recursive rules , Basic data typesand data declarations,

scope rule and forward declaration , Complex data types: array, pointer, string, constants, enumeration, file, and struct types, Specification of Language Syntax , Parameter Passing, Programming Language Constructs, Programming Language Semantics, Specification of Language Syntax, different types of translators, Interpreter, compiler, Assembler, **Python Global variables, Local Variable, Functional Programming, Pure Functional Languages, Impure Functional Language,** Translate coding language

Theory of Computing

Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA and inter-conversion, Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Simplification of CFG: Eliminating Є-productions, unit productions, useless production, useless symbols,Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non- deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs, Turing Machine Model, **Complexity Classes**: Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and hard Problems.

ENGINEERING MATHEMATICS

Mathematical Logic: Propositional Logic; First Order Logic.

Probability: Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

Set Theory & Algebra: Sets; Relations; Functions; Groups; Partial Orders; Lattice; BooleanAlgebra.

Combinatorics: Permutations; Combinations; Counting; Summation; generating functions;recurrence relations; asymptotics.

Graph Theory: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Linear Algebra: Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

Numerical Methods: LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-RaphsonMethods; Numerical integration by trapezoidal and Simpson's rules.

Calculus: Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.