SYLLABUS FOR EXAMINATION

PAPER I (200 marks)

1. General knowledge
2. General English
3. Essay writing
4. English comprehension

PAPER II (200 marks)

1. Simple arithmetic
2. General intelligence & reasoning

PAPER III (200 MARKS)

Technical Paper-I

PAPER IV (200 MARKS)

Technical Paper-II

SYLLABUS FOR DATABASE ADMINISTRATOR

TECHNICAL PAPER-I

1. Relational Database - Structure, schema, keys, schema diagrams, relational query languages, operations – **20 marks**
2. Database Design – ER model, constraints, ER Diagram, Weak entity sets, Dependencies, multivalued dependencies, Normalization/Normal Forms, Decomposition, Anomalies, Algorithms for decomposition, modeling temporal data, UML, ODL – **40 marks**
3. SQL – Data Definition, basic structure of SQL queries, projection, selection, comparison, pattern matching, set operations, null values, aggregate functions, subqueries, nested subqueries, joint expressions, views and indexes, transactions, integrity constraints, data types and schemas, database modifications, constraints and triggers – **40 marks**;
4. SQL in a server environment – Three tier architecture, SQL environment, stored procedures, call level interface, JDBC basics, PHP basics. – **20 marks**
5. Formal Relational Query Languages – relational operations on bags, relational algebra, tuple relational calculus, domain relational calculus – **30 marks**
6. Query processing and optimization – measures of query cost, selection operation, sorting, joint operation, other operations, evaluation of expressions, transformation of relational expressions, estimating statistics of expression results, evaluation plans – **30 marks**
7. Semi structured data model – semi structured data, representation, XML, semantic tags, XML schema, attributes, XML and database, Document type Definition, form of DTD, attribute lists – **20 marks**

TECHNICAL PAPER-II

1. Database system architecture – centralized and client server architecture, server system architecture, parallel system, distributed system, network types – **20 marks**
2. Parallel and distributed systems – Parallel algorithms on relations, distributed databases, distributed query processing, distributed commit, distributed locking, peer-to-peer distributed search – **30 marks.**
3. Query execution – one pass algorithms, two pass algorithms based on sorting, two pass algorithms based on hashing, nested-loop joins, index based algorithms, multipass algorithms. – **30 marks**
4. Transaction management – Transaction - atomicity and durability, isolation, serializability, isolation and atomicity, isolation levels, Concurrency control - lock-based protocol, deadlock handling, multiple granularity, timestamp based protocol, validation based protocol, two phase locking, shared and exclusive locks, tree protocol, Insert Operations, Delete Operations, Recovery – recovery and atomicity, recovery algorithm, early lock release and logical undo operations, rollback, remote backup systems. – **40 marks**
5. Advanced Relational Database – Security and user authorization in SQL, Recursion in SQL, ORM, operations on Object-Relational Data, OLAP, Data cubes. – **30 marks**
6. Information integration – concept, heteregeneity problem, modes of information integration, mediators, wrappers in mediator-base systems, capability-based optimization, optimizing mediator queries, local-as view mediators, entity resolution – **20 marks**
7. Data warehousing and mining – Frequent-itemset mining, Locality-sensitive Hashing, Decision support systems, data warehousing, data mining, classification, association rules, clustering – **30 marks**

SYLLABUS FOR JUNIOR SOFTWARE DEVELOPER
TECHNICAL PAPER-I

1. **Computer System Architecture – 40 marks**
    a. Digital Logic Circuits - Logic gates, boolean algebra, combinational circuits, flipflops, sequential circuits
    b. Digital Components – IC, Decoders, Encoders, Multiplexers, Registers, Shift Register, Binary Counter, Memory Unit
    c. Basic Computer Organization and design – Instruction codes, computer registers, computer instructions, Instruction cycle, Timing and control, Memory Reference Instructions, Input-output and interrupt.
    d. Programming – Machine Language, Assembly language, assembler, program loops, Arithmetic and logic operations, subroutines, input-output programming.
    e. Input-output – interface, Asynchronous data transfer, modes of transfer, priority interrupt, DMA
    f. Memory – hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management.

2. **Operating System – 40 marks**
    a. Structure – UI, system calls, linkers and loaders, design and implementation
    b. Process Management – scheduling, inter-process communication
    c. CPU scheduling – scheduling criteria, algorithms, thread scheduling, multi-processor scheduling
    d. Synchronization – Critical-section problem, solutions, mutex locks, semaphores, monitors, liveness, deadlocks, method for handling deadlock, deadlock prevention, deadlock detection, deadlock recovery and avoidance.
    e. Memory management – contiguous memory allocation, paging, swapping, virtual memory, demand paging, page replacement
    f. File management – file concept, access methods, directory structure, protection, memory mapped files, files system – structure and operations, allocation method, different file systems.

3. **Software engineering – 40 marks**
    a. Software Development Approach - Continuous Integration model, Iterative Development model, Incremental Development model, Prototyping model, Rapid Application Development model
    b. Software Development Life Cycle Methodologies - Waterfall model, Iterative model, Spiral model, V-shaped model, Agile model

c. Software Design Principles - System Models: Data-flow models, Semantic data models, Object models, Inheritance models, Object aggregation, Service usage models, Data Dictionaries, Software Design: The design process, Design Methods, Design description, Design strategies, Design quality, Architectural Design: System structuring, The repository model, The client–server model, The abstract machine model, Control models, Modular decomposition, Domain-specific architectures
d. Object Oriented Analysis and Design – Overview of Object Oriented Systems Development: – Object Oriented Systems Development Life Cycle: – Object Oriented Methodologies: – Unified Modelling Languages (UML) – Object Oriented Analysis – Identifying Use-Cases: – Object Analysis: Classification: – Object Oriented Analysis – Identifying Relationships, Attributes, and Methods: – Object Oriented Design Process and Design Axioms: – Designing Classes – Access Laye: – View Layer

4. Software Testing – 30 marks

a. Software Testing Techniques - Software Testing Fundamental; Testing Principles; White Box Testing; Control Structure Testing; Black Box Testing; Boundary Value Analysis; Testing GUIs; Testing Documentation and Help Facilities.
b. Software Testing Assurance - Verification and Validation: Validation Testing, Validation Test Criteria; Test Plan: Test Documentation; Test Strategies: Top-Down Testing, Bottom-Up Testing, Thread testing, Stress testing, Back-to-back testing; Principles of Testing; Testing methods and tools: Testing through reviews, Black-box testing (Functional testing), White box testing (glass-box testing), Testing software changes; Additional requirements in testing OO Systems; System Testing; Acceptance Testing; Regression testing; Metrics Collection, Computation, and Evaluation; Test and QA plan; Managing Testing Functions.
c. Software Testing Strategies - Introduction; Organizing for software testing; Software Testing Strategy; Unit Testing: Unit Test Considerations; Top-down Integration; Bottom-up Integration.

5. **Database concepts – 30 marks**
    a. Relational Database, Structure, schema, keys, schema diagrams, relational query languages, operations
    b. Database Design – ER model, constraints, ER Diagram, Dependencies, Normalization/Normal Forms Decomposition using dependencies, Algorithms for decomposition
    c. SQL – Data Definition, basic structure of SQL queries, set operations, null values, aggregate functions, nested subqueries, joint expressions, views, transactions, integrity constraints, data types and schemas

6. **AGILE development methods – 20 marks**
    a. Methodology - Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values
    b. Process - Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

SYLLABUS FOR JUNIOR SOFTWARE DEVELOPER
TECHNICAL PAPER-II

1. Web Programming and Scripting – 30 marks
    a. HTML5
    b. CSS3
    c. JavaScript
2. Programming/scripting languages – 90 marks (30 marks each for each language)
    a. C++ – concepts, syntaxes, variables, data-types, operators, loops, functions, strings and arrays, objects & classes, data structures, OOP concepts
    b. Python – concepts, basic syntax, variables, data-types, operators, loops, data structures, dictionary, tuples, functions, modules, objects & classes
    c. Java – concepts, basic syntax, variables, modifiers, data-types, operators, loops, objects & classes, OOP concepts
3. JavaScript Framework– 30 marks
    a. ReactJS - Architecture, JSX, Components, styling, properties, event management, state management, form programming, routing, redux, animation, testing, CLI commands, building and deployment.
    b. AngularJS - MVC architecture, directives, expressions, controllers, filters, tables, HTML DOM, modules, forms, views, scopes, services, dependency injection, custom directives, internationalization
4. Version control System – with focus on GIT – 20 marks
    Basic concepts, life cycle, operations – create, clone, push, update, stash, move, rename, delete, tag, patch; changes – perform, review, commit; managing branches, handling conflicts
5. Object Relational Mapping (ORM) with focus on Hibernate – 20 marks
    Overview, Basic concepts, architecture, sessions, persistent class, mapping, HQL, Criteria, caching, batch, interceptors.
6. Latest trends in IT industry – 10 marks
    Basic concepts on AI and machine learning, blockchain technology, IoT, Cyber Security, edge and quantum computing, etc.

SYLLABUS FOR NETWORK ADMINISTRATOR
TECHNICAL PAPER-I

1. **Internetworking Basics – 30 marks**
    a. Networks, Categories of Networks, Protocols and Standards
    b. IPv4, IPv6 – Datagram, Fragmentation, Checksum, Packet Format, Extension Headers
    c. Transmission Media
        i. Guided media - Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable
        ii. Unguided media: wireless - Radio Waves, Microwaves, Infrared
2. **Network Models – 30 marks**
    a. The OSI Model – layered architecture, peer-to-peer process, encapsulation, layers in the model
    b. TCP/IP protocol suite – layers in the suite, Process-to Process delivery, Connectionless & connection-oriented service, Reliable and unreliable service, UDP, TCP, SCTP.
3. **Addressing – 20 marks**
    a. IPv4 notations, classful and classless addressing, IPv6 structure and address space
    b. Address mapping - ARP, RARP, BootP, DHCP
4. **Connecting Networks – 20 marks**
    a. Connecting devices - Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Gateway
    b. Backbone networks - Bus Backbone, Star Backbone , Connecting Remote LANs
    c. VIRTUAL LANs – Membership, Configuration, Communication Between Switches, IEEE Standard, Advantages
5. **Ethernet and Wireless networks – 20 marks**
    a. IEEE Standards – Data Link Layer, Physical Layer, MAC Layer
    b. Wired Networks - Standard Ethernet, Bridged Ethernet, Switched Ethernet, Full-Duplex Ethernet Fast Ethernet, Gigabit Ethernet
    c. Wireless Networks 802.11 – Architecture, MAX Sublayer, Addressing mechanism, Physical Layer
    d. Bluetooth – Architecture, Layers
6. **Internet and Domain name system – 30 marks**
    a. Architecture of WWW – Client, cerver, URL, Cookies
    b. HTTP – transaction, persistent vs. nonpersistent connection, proxy server
    c. FTP – mechanism, types, data structures, security and vulnerability, FTPS, SSH.

d. Name space - Flat Name Space, Hierarchical Name Space
e. Domain name space – Label, Domain Name, Domain
f. Distribution of name space - Hierarchy of Name Servers, Zone, Root Server, Primary and Secondary Servers
g. DNS in the internet- Generic Domains, Country Domains, Inverse Domain
h. Resolution – Resolver, Mapping Names to Addresses, Mapping Address to Names,
i. Dynamic domain name system (DDNS)
j. Encapsulation

7. Network Management – 20 marks

a. Network management system - Configuration Management, Fault Management
b. Performance Management, Security Management, Accounting Management
c. Simple network management protocol (SNMP) – Concept, Management, Components, Structure of Management Information, Management Information Base (MIB), Lexicographic Ordering
d. SNMP – Messages, UDP Ports, Security

8. Network Security – 30 marks

a. Security services - Message Confidentiality, Message Integrity, Message Authentication, Message Nonrepudiation, Entity Authentication
b. Message confidentiality - Confidentiality with Symmetric-Key & Asymmetric-Key Cryptography
c. Message integrity - Document and Fingerprint, Message and Message Digest, Difference, Creating and Checking the Digest, Hash Function Criteria, Hash Algorithms: MD5, SHA-1, SHA-256
d. Message authentication - MAC
e. Entity authentication – Passwords, Challenge-Response,
f. Key management- Symmetric-Key Distribution, Public-Key Distribution
g. IPSecurity (lPSec) - Two Modes, Two Security Protocols, Security Association, Internet Key Exchange (IKE), Virtual Private Network (VPN)
h. SSL - SSL Services, Security Parameters, Sessions and Connections, Four Protocols, Transport Layer Security
i. FIREWALLS - Packet-Filter Firewall, Proxy Firewall
j. Access Lists - Standard Access Lists, Extended Access Lists, Monitoring Access Lists
k. Intrusion Detection System – classification, detection methods

SYLLABUS FOR NETWORK ADMINISTRATOR

TECHNICAL PAPER-II

1. **Subnetting & IP Routing– 40 marks**
    a. Subnetting Basics - Subnet Masks, CIDR, Subnetting Class C and B addresses
    b. Variable Length Subnet Masks – Design and implementation
    c. IP Routing - Routing Basics, IP Routing Process
    d. Configuring IP Routing – Static and Dynamic Routing, Distance-Vector Routing Protocols, routing loops, maximum hop count, split horizon, route poisoning, holddowns, Routing Information Protocol.
2. **Enhanced IGRP (EIGRP) and Open Shortest Path First (OSPF) – 30 marks**
    a. EIGRP Features and Operation – protocol-dependent modules, neighbor discovery, RTP, Diffusing Update Algorithm (DUAL)
    b. EIGRP basics – Multiple AS, Route discovery and maintenance, EIGRP metrics, Maximum paths and hop count, Configuring EIGRP
    c. Open Shortest Path First (OSPF) Basics – terminology, SPF tree calculation, Configuring OSPF, OSPF DR and BDR Elections, OSPF and Loopback Interfaces
3. **Virtual LANs (VLANs) – 20 marks**
    a. VLAN Basics – broadcast control, security, flexibility and scalability,
    b. VLAN Memberships – static and dynamic VLANS
    c. VLAN Trunking Protocol (VTP) – modes of operation, pruning, routing, configuring
4. **Network Address Translation (NAT) – 20 marks**
    a. Types of Network Address Translation
    b. NAT Names
    c. Static and Dynamic NAT
5. **Windows Server – 20 marks**
    Installation, maintenance, clustering, configuring DNS, IP address management, VPN, PowerShell commands, Active directories
6. **Linux Server – 20 marks**
    basic commands, partitions and file systems, FTP and network commands, managing network, DNS, managing security.
7. **CISCO IOS – 20 marks**
    Interface, CLI, CLI prompts, basic commands, using IOS file system, using Cisco Discovery Protocol (CDP).
8. **Programming Basics - 30**
    a. .NET Framework – CLR, FCL, Core Languages, modules, languages
    b. Java – basic features, syntax, data types, variables, operators, loops, OOP
    c. PHP – basics, variables, functions, arrays and loops, classes & objects