Syllabus for Scientist B

Total Duration : 3 Hours.	No of Questions : 120

Sl.No	Topic
Section A : Generic 35%	
1	Logical Reasoning, Analytical Reasoning Capabilities, Quantitative and Qualitative abilities, General Aptitude.
Section B : Technical (Computer Science) 65%	
1	**Probability, Statistics and Combinatorics:** Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniforms, normal, Exponential, Poisson, Binomial, Permutations, Combinations, Counting, Summation, generating functions, recurrence relations, asymptotic.
2	**Digital Logic**: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits, Number representation and computer arithmetic (fixed and floating point).
3	**Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and data-path, CPU control design, Memory interface, I/O interface (interrupt and DMA mode), instruction pipelining, Cache and main memory, Secondary storage.
4	**Electrical Engineering:** Power Electronics, Signals and Systems, Electromagnetic Fields, Network graph, KCL, KVL, Node and Mesh Analysis, Transient response of DC and AC Networks, Sinusoidal steady-state analysis, Resonance, Super position theorem, Maximum Power transfer theorem, Three Phase Circuits, Power and Power factor in AC Circuits.
5	**Analog and Digital Communication**: Autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems, amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, Super heterodyne receivers, circuits for analog communications, information theory, entropy, mutual information and channel capacity theorem, Digital communications, PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; Timing and frequency synchronization, inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA.
6	**Programming and Data Structures:** Programming in modern languages viz., Java, .Net, Open Source (PHP), Python, GoLang, NodeJS, etc. Functions, Recursion, Parameter passing, Scope, Binding, Abstract data types Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps, Object Oriented Programming Concepts- Object, Class, inheritance, Polymorphism, Abstraction and Encapsulation.
7	**Algorithms**: Analysis, Asymptotic, notation, Notions of space and time complexity, Worst and average case analysis, Design; Greedy approach, Dynamic programming, Divide-and-conquer, Tree and graph traversals, Connected competent, Spanning trees, Shortest paths; Hashing, Sorting, Searching, Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concept of complexity classes-P, NP, NP-hard, NP-complete.
8	**Compiler Design:** Lexical analysis, Parsing, Syntax directed translation, Runtime environments, intermediate and target code generation, Basics of code optimization.

Detailed Advertisement for the Post of Scientist - 'B' and Scientific/Technical Assistant – 'A '
Ref. *No: NIELIT/NIC/2020/1*

Page 10 of 14

9	**Operating System**: Processes, Threads, lnter-Process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.
10	**Databases**: ER-model, Relational Model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control, NoSQL Databases, questions on internals of Postgres SQL.
11	**Information Systems and Software Engineering:** Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, Implementation, maintenance.
12	**Computer Networks:** ISO/OSI stack, LAN technologies, Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), IP(v6), Application layer protocols, (ICMP, DNS, SMTP, POP, FTP, HTTP, HTTPS), Basic concepts of hubs, switches, gateways and routers. Wireless technologies, Network security -basic concepts of public key and private key cryptography, digital signature, firewalls.
13	**Web Technologies:** HTML5, CSS3, XML, basic concept of client-server computing, web server, proxy server, web application development, MVC Architecture, web services, frontend technologies.
14	**Cyber Security and Emerging Technologies:** Secure programming techniques, OWASP top 10 vulnerabilities, concepts on IOT, Block chain, AI etc..
15	**Cloud Technology:** Compute, Network, Storage Management Technologies, Edge Computing etc.

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Detailed Advertisement for the Post of Scientist - 'B' and Scientific/Technical Assistant – 'A '
Ref. *No: NIELIT/NIC/2020/1*

Page 11 of 14

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Sl. No	Topic
Section A : Generic 35%	
1	Logical Reasoning, Analytical Reasoning Capabilities, Quantitative and Qualitative abilities and General Aptitude.
Section B : Technical (Computer Science) 65%	
1	**Probability and Statistics:** Sampling theorems, Conditional Probability, Mean, Median, Mode and standard deviations, Random Variables discrete and continuous distributions, Poisson, Normal and Binomial distribution, correlation and regression analysis.
2	**Digital Computer Principles:** Number systems- Binary, Decimal, Octal, and Hexadecimal Conversion, Arithmetic operations, Boolean expression, simplification, Postulates and theorems, Simplifications, K-map, Combinational Logic circuits – Adder, Subtractor, Multiplexer, Demultiplexer, Encoder, Decoder, Sequential circuits – SR, JK, T, D, flip flops, shift registers, Asynchronous, synchronous and Module and counters.
3	**Computer Organization and Architecture:** Multiprocessors and microcomputers, Machine Instructions and addressing mode. ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Cache and main memory, Secondary storage, Semiconductor memory – Internal organization, SRAM, DRAM, SDRAM, Rambus Memory, ROM Technology, virtual memory, Instruction sequencing, Instruction execution, Hardwired control and microprogrammed control, micro instructions, Instruction pipelining.
4	**Programming and Data Structures** : Programming in C, Functions , Recursion, Parameter passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search tress, Binary heaps.
5	**Object Oriented Programming:** Object Oriented design concept, programming in C++ and on programming languages viz., Java, .Net , Open Source (PHP), Python, GoLang, NodeJS, etc
6	**Algorithms**: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis, Design; Greedy approach, Dynamic programming, Divide and conquer; Tree and graph traversals, Connected Components, Spanning trees, Shortest paths, Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds. Basic concept of complexity classes, N, NP, NP-hard, NP-complete.
7	**Databases**: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.
8	**System Software:** Lexical analysis, parsing, syntax directed translation, code generation and optimization, Assemblers, linkers and loaders for microprocessors, operating systems - processes, threads, inter-process communication, synchronization, deadlocks, CPU scheduling, memory management and virtual memory , file system, I/O systems, protection and security module.
9	**Information Systems and Software Engineering:** Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and

Detailed Advertisement for the Post of Scientist - 'B' and Scientific/Technical Assistant – 'A '
Ref. *No: NIELIT/NIC/2020/1*

Page 12 of 14

	managing the project, design, coding and testing, implementation, maintenance.
10	**Computer Networks:** ISO/OSI stack, LAN technologies (Ethernet, Token Ring), flow and error control techniques, Routing algorithm, Congestion Control, TCP/UDP and sockets, IP(v4), Application layer protocol (ICMP, DNS,SMTP, POP, FTP, HTTP, HTTPS) : Basic concept of hubs, switches, gateways and routers. Network security: basic concepts of public key and private key cryptography. Hash function, Digital Signature, Firewalls, User authentication - Token based, Biometric, Remote user authentication, Intrusion detection systems, honey pots, Denial of Service. Wireless network, 2G and 3G Networks, Bluetooth.
11	**Web Technologies:** HTML5, CSS3, XML, basic concept of client-server computing, web server, proxy server, web application development, MVC architecture, web services, frontend and backend technologies.

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Detailed Advertisement for the Post of Scientist - 'B' and Scientific/Technical Assistant – 'A '
Ref. *No: NIELIT/NIC/2020/1*

Page 13 of 14