




CENTRAL POLLUTION CONTROL BOARD
(Ministry of Environment, Forest & Climate Change)
Parivesh Bhawan, East Arjun Nagar
Delhi - 110032

Indicative Syllabus for written test for the post of Scientist 'B'

General Instructions:

1. There will be common questions on General Science, General English, and General Aptitude.
2. The general questions shall consist of 40 marks and subject specific questions shall carry 60 marks.
3. The total time duration shall be 2 hours.
4. The written examination question papers shall consists of objective, reasoning, short answers, subjective, descriptive types, flow & circuit diagrams and also general mathematics to the desired qualifications.
5. Candidates will not be allowed to carry any electronic gadget at the examinations hall.
6. The general and subject specific syllabus for the written exam is given at the next page.


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General subjects for Post – 1 (all Scientist-B posts):

- Environmental Laws
- International Environmental Treaties
- Water Quality Assessment
- Drinking Water Quality
- Climate Change
- Environmental Meteorology
- Environmental Sciences
- General Mathematics
- General knowledge, science
- Mental Ability
- English


	Name of Post	Syllabus
Paper-1(A)	Scientist-B (Chemical, Civil & Environmental Engineering)	Subject Specific: <ul style="list-style-type: none">- Chemistry for Environmental Engineering- Sewage Treatment Plants- Air Pollution Control Technologies- Waste Management (Solid Waste, Hazardous waste, E-Waste, Biomedical Waste, Plastic waste and used Batteries waste)- Industrial Wastewater Treatment (Design of ETPs/CETPs etc.)- Sewerage and Water Supply Engineering- Noise Pollution & Control- Basic Hydraulic Engineering (measurement of flow, etc.)- Landfill Design- Soil Contamination & Remediation- Water & Air Quality sampling- Industrial Pollution Control (Thermal Power Plant, Tanneries, Dairy, Steel and Oil Refineries)- Sensors & Transducers, Measurement techniques used in GC / GC-MS / NDIR / Spectrophotometer / HPLC / AAS / ICP / ERY / ED-ERF / Flame photometer / FTIR / Etc.- Continuous Emission Monitoring Systems- Units and Standards. Measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance. Capacitance and frequency.


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Paper-1(B)	Scientist-B (Electrical)	Subject Specific: <ul style="list-style-type: none">- Energy efficient lightning, Energy efficient Air Conditioning system, Energy efficient materials for green building, Solar panels etc. Energy audit.- Gauss's Law and Amperes Law. Fields in dielectrics, conductors and magnetic materials.- Band Theory. Conductors, Semi-conductors and insulators. Super-conductivity. Insulators for electrical and electronic applications. Magnetic materials. Ferro and ferrimagnetism. Ceramics, Properties and application. Material audit and balance- Circuits elements. Kirchoff's Laws. Three phase circuits. Two-port networks. Elements of two-element network synthesis.- Units and Standards. Measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance. Capacitance and frequency.- Power transformers. Construction and testing. Equivalent circuits. Losses and efficiency. Regulation. Auto-transformer, 3-phase transformer. Parallel operation. Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency. D.C. Machines. Construction, Excitation methods. Circuit models. Armature reaction and commutation. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing. Losses and efficiency. Synchronous Machines. UPS etc- Maintenance of sub -station, Electrical rooms, Air conditioning system, pump room, generators.
Paper-1(C)	Scientist-B IT/Computer Science,	Subject Specific: <ul style="list-style-type: none">- Computer: History of Computer and their classification, Basic Organization, Memory – RAM, ROM, EPROM, etc, Magnetic-Floppy, Hard disks, CDROM, WORM etc, Concept of Virtual Memory and Cache Memory, Number systems, binary octal, Hexadecimal, Binary Addition, Subtraction and Multiplication, Flotation, point representation and arithmetic, Arithmetic through stacks.- Operating systems: assemblers, elements of Assembly language programming-Overview of the Assembly process, assembler for the IBM PC, Process synchronization, Memory Management – address Binding – dynamic Loading and linking – overlays – logical and Physical address space – Contiguous Allocation – internal & External Fragmentation. Non-Contiguous Allocation: Paging


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		<p>and Segmentation Schemes - Implementation - Hardware Protection - Protection - sharing - Fragmentation.</p> <ul style="list-style-type: none"> - Virtual Memory: Demand Paging - Page Replacement - Page Replacement algorithms - Thrashing. - File System: File Concepts - Access Methods - Directory Structures - Protection Consistency Semantics - File system Structures - Allocation Methods - Free Space Management. - I/O System: Overview - I/O hardware - Application I/O Interface - Kernel I/O subsystem, Performance, Secondary Storage Structures, Protection, Goals, Domain - Access matrix. - Assemblers: Elements of assembly language programming - Overview of the Assembly process - Design of a low-pass Assembler - a single pass Assembler for the IBM PC. The security Problem - Authentication - Threats - Threat Monitoring - Encryption. - Fundamentals of programming: Unix Programming, Programming in FORTRAN, C, Object Oriented Programming in C++, programming in Java, Basics of compilers. - Database Management Systems: Advantages and components of a Database Management Systems, Data Types, Data Dictionary, Query Basics, Forms and Reports, Graphical objects, Error Handling, Distributing Application, Data Storage Methods, Data Clustering and Partitioning, Database Administration, Backup and Recovery, Security and Privacy, Distributed Databases, Client/Server Databases, Object Oriented Databases, Integrated Applications, SQL, RDBMS. - Internet Technology: Basics, topologies, layers, switching in the networks, bridges, routers and gateways, types of networks, WWW. Client/Server Applications, Internet Standards and specifications, ISP, Broad Band Technologies, Protocols, web-servers, browsers, and security, fire walls, data security, HTML, dHTML, XML, Web designing. - Fundamentals of Geographical Information System (GIS): GIS Data and Spatial Models, Topology and Spatial Operations, Projections, Scale and Coordinate Systems, Mapping, GIS Analysis, Cartography. Basics of GIS application development.
Paper-1(D)	Scientist-B Electronics & Communications	<p>Subject Specific:</p> <ul style="list-style-type: none"> - Conductors, Semi-conductors, Insulators, Magnetic, Passive components, characteristics of Resistors, Capacitors and inductors. PN Junction diode, forward and reverse bias characteristics and equivalent circuits of diode, Zener diode and applications, clipping, clamping and rectifier circuits using diodes. - Bipolar Junction Transistors (BJT) Field Effect Transistor (FET) and MOSFET; Biasing and stability, Emitter follower and its applications - Negatives feed back-Transistor as a switch, Multistage


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		<p>Amplifiers, Feedback, Oscillators, Voltage regulation, Power amplifiers.</p> <ul style="list-style-type: none"> - Introduction to Network Theorems: Kirchoff's laws, superposition, Thevenin's Norton's and Maximum power theorems. - Voltage and Current relationship in the resistance, inductance and capacitance. Concept of reactance, susceptance, conductance, impedance and admittance in series and parallel RL, RC and RLC circuits - Three phase supply-star and delta connection diagrams - Relation between line and phase & voltages and currents, series and parallel resonance circuits - condition of resonance, resonant frequency, Q factor and bandwidth. - Digital electronics: - Logic gates, Demorgan's theorem, Boolean algebra, frequency counters, flip-flops, shift registers, Basic concepts of Digital to Analog and Analog to Digital Converters. - Modulation, types of modulation, Amplitude Modulation (AM), Modulation index, Power relation in AM, Generation and Demodulation of AM. Single Side Band (SSB): Power requirement in comparison with AM, Advantages of SSB over AM. Concept of Balanced Modulator, Generation of SSB, Pilot Carrier System. Independent Side System, Vestigial Sideband Transmission. - Frequency Modulation (FM): Definition of FM, Bandwidth, Noise triangle, Pre-emphasis and De-emphasis. Pulse Modulation (PM): Definition of PM. Difference between AM and FM. Radio receivers. Sampling Theorem, PAM, PTM, PWM, PPM, pulse code modulation, Quantization noise, companding, PCM system, differential PCM, Delta modulation. Multiplexing: FDM/TDM. Introduction of digital Communication: PSK, ASK, FSK, introduction to fiber optics system, Propagation of light in optical fiber and satellite communications.
Paper-1(E)	Scientist-B Electronics & Instrumentation,	<p>Subject Specific:</p> <ul style="list-style-type: none"> - Characteristics and applications of diode, Zener diode, BJT and MOSFET; small signal analysis of transistor circuits, feedback amplifiers. Characteristics of operational amplifiers; applications of opamps: difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier. - Combinational logic circuits, minimization of Boolean functions. Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flip-flops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog-to- digital (successive approximation, integrating, flash and sigma-delta) and digital-to- analog converters (weighted R, R-2R ladder and current steering logic). - SI units, systematic and random errors in measurement, expression of uncertainty - accuracy and precision index, propagation of errors. PMMC, MI and dynamometer type instruments; dc


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		<p>potentiometer; bridges for measurement of R, L and C, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter; oscilloscope, shielding and grounding.</p> <ul style="list-style-type: none"> - Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (differential pressure, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity and viscosity measurement.
Paper-1(F)	Scientist-B (Chemistry)	<p>Subject Specific:</p> <ul style="list-style-type: none"> - Environmental Chemistry - Environmental Microbiology - Analytical Chemistry including chemical mass balance - Bio-monitoring , Bioremediation - Environmental Laws - International Environmental Treaties - Water Quality Assessment Parameters - Drinking Water Quality - Assessment of Waste and Soil Contamination - Atmospheric Chemistry - Air Sampling - Water Sampling - Industrial Process Controls
Paper-1(G)	Scientist-B (Microbiology)	<p>Subject Specific:</p> <ul style="list-style-type: none"> - Diversity of Prokaryotic and Eukaryotic Microbes - Microbial Physiology and Metabolism - Virology - Immunology - Enzyme and Techniques in Biochemistry - Environmental Microbiology - Plant - Pathogen Interaction - Microbial Pathogenicity - Molecular Biology - Recombinant DNA Technology - Microbial Genetics - Industrial and Food Microbiology - Bioinformatics - Bio-indicators

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