SYLLABUS FOR WRITTEN TEST :
ADVERTISEMENT NO: HRAQ/REC-EX-B/2024-02 dated 05.01.2024

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF
SUPERINTENDING MEDICAL OFFICER (ORTHOPEADICS)
[POST CODE ţ (MD 01)]

- Spinal injury assessment and management.
- Upper limb and Lower limb – pathologies, assessment and management.
- Musculoskeletal tumors.
- Paediatric Orthopedics.
- Sports medicine and sports injury.
- Recent advances.
- ATLS.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF
SUPERINTENDING MEDICAL OFFICER (RADIOLOGY)
[POST CODE ţ (MD 02)]

- Ultrasound Physics.
- MRI Physics.
- Recent advances in Radiology.
- Radiologic anatomy of the whole body.
- Radiologic features of different diseases pertaining to various organs of the body.
- Radiologic interventions.
- Radiation Physics.
- Clinical applications of MRI.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SUPERINTENDING ENGINEER (ENVIRONMENT)

[POST CODE – (ENV 03)]

SL. No	Course title	Syllabus
1	Environmental Chemistry:	1. Fundamentals of Environmental Chemistry. 2. Principles of Water Chemistry. 3. Soil Chemistry. 4. Atmospheric Chemistry.
2	Environmental Microbiology:	1. Prokaryotic and Eukaryotic Microorganisms; Characteristics & Classification; Plant -microbe and soil microbe interactions; Role of microorganisms in wastewater treatment and bioremediation. 2. Microbial Metabolism 3. Growth and control of Microorganisms. 4. Microbiology and health.
3	Water & Wastewater Treatment and Management	1. Water and wastewater quality parameters; Eutrophication and thermal stratification in lakes; River Pollution - Oxygen sag curve. 2. Water treatment methods. 3. Point and non-point sources of wastewater; Population forecasting methods; Design of sewer and storm water sewers; Sewer appurtenances; Preliminary, Primary, Secondary and tertiary sewage treatment, Sludge generation, processing and disposal methods; Sewage farming. 4. Sources and characteristics of industrial effluents; Concept of Common Effluent Treatment Plants (CETP); Wastewater recycling and zero liquid discharge. 5. Kinetics and reactor design.
4	Air and Noise Pollution:	1. Structure of the atmosphere, Natural and anthropogenic sources of pollution, Atmospheric sources, sinks, transport, Indoor air pollution, Effects of health and environment, Air pollution: gases and particulate matter, Air quality standards, Primary and secondary pollutants, Criteria pollutants, ambient and source standards, air quality indices, visibility. 2. Particulate Pollutants. 3. Gaseous Pollutants. 4. Automotive emission controls, fuel quality, diesel particulate, filters, catalytics convertors. 5. Air Quality Management. 6. Noise Pollution. 7. Instrumentation Techniques for Environmental Monitoring.
5	Solid and Hazardous Waste Management:	1. Integrated solid waste management, waste hierarchy, Rules and regulations for solid waste management in India. 2. Municipal solid waste management in India. 3. Hazardous waste management. 4. Soil contamination and leaching of contaminants into groundwater. 5. Management of Biomedical waste, Plastics waste, E-waste, Construction & Demolition Waste.
6	Global and Regional Environmental Issues:	1. Global effects of air pollution-Greenhouse gases, global warming, climate change, urban heat islands, acid rain, ozone hole 2. Principles of International Law and international treaties. 3. Environment conventions and protocols.
7	Environmental Management and Sustainable Development	1. Environmental Management Systems, ISO14000 series, Environmental auditing: Environmental Impact Assessment, Life cycle assessment, Human health risk assessment. 2. Environmental Law and Policy: Water Act, 1974 and Air Act, 1981 with amendments, The Environment (Protection) Act (EPA) 1986, National Green Tribunal Act, 2010, EIA Notification 2006 with amendments, Forest Conservation Act 1980 with amendments, Wildlife Protection Act 1972, Coastal regulation Zone (CRZ) Notification 2019, Central Ground Water Authority (CGWA) guidelines for groundwater extraction. 3. Renewable and Non-renewable energy sources.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (CHEMICAL)

[POST CODE – (CE-04)]

Sl No	Course Title	Syllabus
1	**Inorganic Chemistry**	1. Chemical Bonding & structure 2. Acid Base and Redox Chemistry 3. Inorganic reactions and mechanism 4. Symmetry and Group Theory in Chemistry 5. Chemistry of Lanthanides and Actinides 6. Properties of transition metal complexes 7. Magnetochemistry 8. Electronic Spectra of Transition Metal Complexes 9. Inorganic Photochemistry 10. Characterization of inorganic compounds
	Organic Chemistry	1. Structure, Reactivity and reactionmechanism of organic compounds. 2. Stereochemistry 3. Retrosynthesis/importance of synthetic planning in organic synthesis 4. *NMR spectroscopy* 5. Heterocyclic Chemistry 6. Petroleum Technology 7. Oxidation -Reduction Reactions 8. Photochemistry of organic compounds 9. Bio-Chemistry- Enzymes and Co-enzymes, Nucleic acids 10. Separation techniques of organic compounds and their spectroscopic identification. Experiments involving the separation and purification of organic compounds from a mixture, using chromatographic techniques, steam distillation, fractional crystallization and sublimation. 11. Chemistry of Paints and Surface Coating Technology 12. Fundamentals of industrial polymers 13. Basics of polymer chemistry.
3	**Physical Chemistry**	1. Equilibrium and Non-equilibrium Thermodynamics: Phase Rule 2. Surface Chemistry & Catalysis 3. Statistical Thermodynamics 4. Chemical Kinetics and Reaction Dynamics 5. Electrochemistry 6. Solid State Chemistry 7. Crystals, crystal symmetry, including the principles and practices of X-ray crystallography 8. Surface phenomena like curve surface, capillary action, adsorption 9. Structure and properties of different colloidal dispersion 10. Advanced Electrochemistry

Sl No	Course Title	Syllabus
4	**Analytical Chemistry**	1. UV-Visiblespectrometer and FT-IR. 2. Polarography, X-Ray Diffractions. 3. Chromatographic methods: Adsorption, liquid-liquid partition, ion–exchange, HPLC, gel permeation chromatography gas chromatography, HPTLC, Flash chromatography 4. Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), AtomicForce Microscopy (AFM) 5. Characterization of organic molecules- Applications of IR, UV-visible, NMR, Mass spectrometry, LC-MS 6. Characterization of inorganic molecules- Applications of IR, Raman, NMR, EPR, Mössbauer, UV-visible, NQR, MS, electron spectroscopy and microscopy 7. Microscopy- Optical microscopy, Reflectance, Transmittance, Fluorescence Microscopy, CLSM, Ultra-high resolution microscopy 8. Analytical Spectroscopic Methods- Atomic Absorption Spectroscopy (AAS), Atomic (or Optical) Emission Spectroscopy A/OES 9. X-ray methods: X-ray diffraction, X-ray fluorescence and X-ray absorption and X-ray emission spectroscopy.
5	**Green and Sustainable Chemistry**	1. Introduction to Green Chemistry 2. Principles of Green Chemistry 3. Importance in modern chemical laboratory/industry 4 . Examples of Green Reagents/ Synthesis/ Reactions 5. Waste: production, problems and prevention 6. Analysis and purification of water, wastewater, solid-waste and air pollution. 7. Environmental protection and pollution prevention 8. Adverse Effects of Chemicals on Health and the Environment; Green Chemistry Problems 9. Environmental impact and quality parameters of air, water and soil 10. Green chemistry in sustainable development- Designing Sustainable Solutions
6	**Spectroscopy**	1. NMR spectroscopy, ESR spectroscopy, Mossbauer spectroscopy, NQR spectroscopy 2. Spectroscopy- Electromagnetic spectrum, Rotational (microwave), Vibrational and Raman spectroscopy, Electronic spectroscopy etc. 3. Mass spectrometry

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (ELECTRICAL)

[POST CODE – (EE-05)]

Sl.No	Topic	Description
1	Circuits And Networks	Circuits and Networks, two port network, Transient in electric circuit, Magnetically coupled circuit, Graph Theory, Application of Laplace Transform, Frequency Response, Fourier Analysis, Filter Circuits
2	Electromagnetic Field Theory	Vector Analysis, Electrostatics, Magnetostatics, Electromagnetic field, Materials and fields, Electromagnetic waves.
3	Electrical Measurement and Measuring Instruments	Characteristic of Instruments and Measuring Systems Measuring Instruments, Potentiometers A. C. & D. C. Bridges, Magnetic Measurement Instrument Transformer Measurement of resistance, Inductance, Capacitance, Voltage, Current, Power, Power Factor and Electrical Energy
4	Power System	General Introduction, Transmission Line Parameters, Performance of Transmission Lines, Underground Cable, Distribution, Mechanical Design: (a) Line support, (b) Insulators, (c) Sag, (d) Corona Substation, Neutral Grounding, Circuit Breakers, Protective Relays Over-Voltage Phenomenon in Power Systems, Over-Voltage Protection & Insulation Coordination HVDC Transmission and Systems of Electric Power Transmission & Load Management Economic operation of steam Power plant, Elements of Hydrothermal co-ordination, Transients in power systems.
5	Signal and System	Introduction to signals and systems, Introduction to system, Representation of signals, Statistical Signal Analysis.
6	Electrical Machines	Electro-mechanical Energy Conversion, D C Machines, D C Motors, Transformer, Special Machines, Stepper motor, Servomotors. Fundamentals of AC Machine Windings, Poly-phase Induction Machines, Single-phase Induction Motors, Synchronous Machines, Other Motors: Phase Commutator Motors: Universal and repulsion motors, Reluctance Motors (Conventional and Switched), Stepper Motor, Brush-less DC motor (BLDC).
7	Control System	Fundamentals of control system, Physical system modelling, introduction to control system components, time domain analysis, the root locus technique, frequency domain analysis Compensation techniques, Discrete time systems, State – space analysis of control systems, Describing function analysis, Phase- plane analysis, Stability analysis by Liapunov's method, Design of feedback control systems.
8	Microprocessor And Microcontroller	Introduction, Microprocessor architecture, Programming microprocessors, Memory interfacing, Data transfer techniques and their implementation, Microcontrollers, Common peripherals and their interfacing, Important features of some advanced microprocessor, Applications of Microprocessors.

Sl.No	Topic	Description
9	Power Electronics	Semiconductor, Power Devices, Converter Operation With SCRS: (i) Single phase-controlled rectifiers (ii)Three - phase controlled rectifiers (iii) Dual converter and Cycloconverter operating modes, AC voltage controller., SCR Commutation Circuits and Inverters: (i) Commutation schemes (different classes), Forced commutation circuits. (ii) Single-phase and Three-phase Inverters (iii) Voltage and current source inverters. Output voltage control, harmonics eliminations. Firing circuits for inverters. Choppers, Applications.
10	Switchgear And Industrial Protection	Symmetrical Fault Analysis, Symmetrical components and Unsymmetrical Fault Analysis, Neutral Grounding, Circuit Breakers, Protective Relays, Sub-Stations, Lightning Arrester.
11	Industrial Drives	Introduction, Dynamics of Electrical Drives, Selection of Motor Power Rating, Starting, Electric Braking, Control of Electrical Drives, Control of DC Drives, Thyristorised AC & DC Motor Drives, Mechanical Features for Electrical Motors, Control of Induction Motor Drives, Industrial Applications.
12	High Voltage AC/DC	Breakdown mechanism of gases, Liquid and solid materials, Electrical properties of high vacuum, Over voltage phenomenon & Insulation co-ordination, High voltage generation, Measurement of High voltage & currents, High voltage Equipment, High voltage Testing and testing techniques, Design, planning and layout of high voltage laboratory.
13	Flexible AC Transmission System	Flexible AC Transmission System (FACTS): Concept and opportunities, Basic concept of voltage source converter (VSC) and Current source converter (CSC). Power flow in AC Systems Static Shunt Compensation: SVC and STATCOM. Operation and Control of TSC, TRC and STATCOM. Compensatory Control, Comparison between SVC and STATCOM. Unified Power Flow Controller Applications, Introduction to interline power flow.
14	Electric Power Utilization, Traction & Conservation of Electrical Energy	Electric Heating, Welding, Traction, Storage Electrical Losses & Energy Conversion Electrical transmission, distribution & utilization losses. Classification. Reduction of losses. Benefits of electrical energy conservation. Energy conservation in lighting, electric furnaces, electric drive, traction systems. Use of energy –efficient equipment. Electrical Energy Audit.

Sl.No	Topic	Description
15	Renewable Energy Sources and Management	Non-Conventional Energy Sources, Introduction to Non-Conventional Energy Sources Solar Energy, Photovoltaic Energy Conversion, Wind Energy, Fuel Cell, Energy From Biomass, Geothermal Energy Energy From the Ocean: Tidal power, components of tidal power plants, generation of tidal power, estimation of energy & power, ocean thermal energy conversion (OTEC): introduction, types, plants & their specifications. Magneto Hydro- Dynamic Generation & Other resources: Small Hydro Schemes, Hydrogen Energy, Thermoelectric generations etc. Combined Operation Utilizing More than One Source, Composite Systems. Solar Radiation, Applications of solar energy, Bioconversion, Wind energy, Energy Management & Conservation
16	Distribution System Planning and Automation	Configuration of distribution systems, load characteristics, distribution transformers, distribution substation design, feeder design, voltage regulation, protection in distribution systems, SCADA, distribution automation.
17	Power Plant Engineering	Introduction to Power Plant Engineering Diesel Plant Hydro Electric Plant Gas-Turbine Plants Modern Trends in Power Plant Operation: Use of computers in power stations, on-line computer control of power systems (SCADA), load dispatching and load forecasting.
18	Illumination Technology	Basics of Illumination Engineering The Visual System Light Sources and Their Characteristics, Control of Light Illumination & Measurement Lighting Applications and Design Calculations.
19	Modelling and Simulation	System Models and Role of Simulation, Statistical Tool, Discrete Event Simulation, Modelling and Performance Evaluation of Computer Systems, Continuous System Simulation, Virtual Reality Modelling, Verification and Validation of Simulation Models.
20	Electrical Engineering Materials	Dielectrics, Behaviour of dielectrics in alternating fields, Magnetic Properties of materials, Conductors, Properties of Semiconductors, Conducting materials, Insulating materials.
21	Instrumentation	Introduction, Analytical Instrumentation, Transducers & sensors, Non-destructive testing equipment, Data transmission & telemetry.
22	Advanced Engineering Mathematics	Linear Algebra, Complex variable, Calculus, Vector Analysis, Linear Programming, Transform Calculus, PDE.
23	Analog Electronics	Review of PN junction diode, Linear Wave Shaping, Bipolar Junction Transistor, MOSFET, BJT configuration, Multi-stage Transistor Amplifiers, Operational Amplifiers, Introduction to Feedback Amplifiers.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (FIRE & SAFETY)

[POST CODE – (FS-06)]

Sl. No	Subject
1	Engineering Graphics, Basic of Civil Engineering, Basics of Electrical Engineering, Advanced Electrical Systems, Applied Chemistry
2	Basics of Mechanical Engineering, Automobile Engineering, Robotics
3	Advanced Engineering Materials, Engineering Mechanics, Engineering Thermodynamics, Heat and Mass Transfer, Fluid Mechanics, Structural Mechanics
4	Mathematics-II, Computational skills
5	Instrumentation and Control, Basic Electronics and Communication
6	Energy and Environment, Indian Culture & Constitution, Universal Human Values-II, Fundamentals of Management
7	Fundamentals of Fire Engineering
8	Fire Service Hydraulics
9	Structural Fire Protection
10	Fire Dynamic
11	Fire Protection
12	Fire Laws
13	Fixed Fire Fighting Installations
15	Fundamentals of Industrial Safety and Health, Chemical Process Safet
16	Fire Codes and Standards, Fire and life Safety Audit
22	Principles of Safety Management, Behavior Based Safety
14	Fire Modelling
17	Fie and Arson Investigation
18	Fire and Risk Assessment
19	Special Hazards, Nuclear Reactors and Safety
20	Occupational Health and Hygiene Management
21	Disaster Management

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR ACCOUNTS OFFICER/ SENIOR INTERNAL AUDITOR

[POST CODE – (AC-07)]

Sl.No	Topic	Description
1	Financial Accounting & Reporting	Accounting Standards- Introduction and Overview, Carve outs/ins in Ind ASs vis-à-vis International Financial Reporting Standards (IFRSs), Preparation of Financial statements of Company viz. Cash flow Statement (Profit and Loss Account, Balance Sheet and Cash Flow Statement)- Profit/Loss prior to incorporation as per Schedule II of Companies Act, SEBI Regulations only related to financial matters excluding Secretarial issues, Internal Financial Controls (IFC).
2	Cost and Managing Accounting	Introduction to Cost Accounting, Materials, Labor, Overheads, Non-Integrated Accounts, Methods, Job and Batch, Contract, Operating, Process and Operation, Standard Cost, Marginal Costing, Budget and Budgetary Control, Cost Management, Cost Volume Profit Analysis, Pricing Decisions, Budgets and Budgetary Control, Standing Costing and Variance Analysis, Transfer Pricing, Cost Management in Service Sector and Financial Decision Modelling, Employee Stock Option and buy back of securities, Capital Budgeting.
3	Company Law and Allied Laws	Company Law 2013, Insolvency and Bankruptcy Code 2016, The Indian Contract Act, 1872; The Negotiable Instrument ACT, 1881, The Payment of Bonus Act 1965, The Foreign Exchange Management Act, 1999.
4	Direct Tax Laws	The Income Tax Act, 1961 and Rules thereunder.
5	Indirect Tax Laws Including Goods and Services Tax & Customs & Foreign Trade Policy	Goods and Services Tax (GST) Law as contained in the Central Goods and Services Tax (CGST) Act, 2017 and Integrated Goods and Services Tax (IGST) Act, 2017, Customs Law as contained in the Customs Act, 1962 and the Customs Tariff Act, 1975 and Foreign Trade Policy to the extent relevant to the indirect tax laws.
6	Auditing and Assurance	Auditing Concepts, Auditing and Assurance Standards, Preparation for an Audit, Internal Control, Vouching, Verification of Assets and Liabilities, Company Audit, Audit Report, Special Audit, Cost Audit and Record Rules, Risk Analysis & Mitigation.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (MECHANICAL)

[POST CODE – (ME-08)]

Sl.No	Topic	Description
1	Theory of Machines	Simple Mechanisms, Friction and Friction Drives Displacement, velocity, and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope. Analysis of Plane Motion with Velocity diagram, Acceleration diagram; Kinematic synthesis of linkages;
2	Machine Design	Types of Loads, Failure Theory, Designed stress and factor of safety, stress concentration, selection of materials, codes for design-BIS codes, Modes of Failure, Failure theories, Fits and Tolerance. Shafting: Design of shaft subjected to bending, torsion, axial and combined loading Keys, Cotter and Knuckle joint Coupling: Rigid and Flexible coupling Power Transmission Elements: Belt and Chain Drives, design of Flat and V-belts Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted' riveted and welded joints; shafts, gears, rolling and sliding contact bearings' brakes and clutches' springs. Design of Mechanical Springs – helical spring, Gears: Spur and Helical gear Design of Friction clutches – single and multidisc clutch, cone clutch, Brakes – Disc, cone, band and internal expanding shoes Tribology, Design of Bearings – radial and Thrust journal bearings, Selection of Rolling Contact Bearings
3	Vibrations	Basic Concepts Measurement of Vibrations Seismic transducers (ii) LVDT accelerometers (iii) Piezo-electric accelerometers Free and forced vibration of single degree of freedom systems' effect of damping; vibration isolation; Resonance; Critical speed of a shaft for whirling motion. Two Degrees of Freedom System (2DOF) Seismic Instruments Multi Degree of Freedom Systems (MDOF)

Sl.No	Topic	Description
4	Engineering Mechanics	Equilibrium of Rigid Bodies Analysis of Structures Friction Centre of Gravity and Moment of Inertia Lifting Machines Virtual Work and Energy Method Impulse, Momentum, Work and Energy Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain, Strain Rosette. Thin & Thick cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts. Eule/s theory of columns. Testing of materials with universal testing machine (Uniaxial Tension Test/ engineering stress-strain curves,) Testing of hardness and impact strength: Rockwell, Brinell and Vickers and their relation to strength.
5	Engineering Materials	Structure and properties of engineering materials: Crystal Directions and Planes. Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions Heat treatment (Alloy), stress-strain diagrams for engineering materials. Pattern making and sand casting – Pattern materials – Types – Pattern allowances. Core prints. Moulding sand – ingredients – classification – sand additives – properties of moulding sand – sand preparation and testing. Green sand mould preparation. Cores and core making – Types of cores Principles of powder metallurgy. Principles of welding, brazing, and soldering.
6	Machining and Machine Tool Operations	Mechanics of machining; Basic machine tools - Machining, definition, and objectives. Geometry of cutting tools. Cutting Tool Specification - single and multipoint cutting tools and materials, Mechanics of metal cutting, Mechanism of chip formation, Cutting tools materials and methods of failure; Assessment of tool life. Economics of Machining. Non-Conventional Machining process - Principles of operation, Applications, Merits and Demerits of different non-conventional machining; Principles of work holding, Design of jigs and fixtures Kinematics of Machine Tools Measurement by Dynamometry
7	Metrology and Inspection	Introductory Concept of engineering metrology, Statistical Process Control, Tolerance, Limits of Size and Fits, Tool Room Measuring Instruments; Measurement of Screw Threads Measurement of Gears. Surface Texture Interferometry Alignment Testing

Sl.No	Topic	Description
8	Production Planning and Control	Production Planning and Control (Forecasting Models, Aggregate Production Planning, Scheduling, Material Requirement Planning). Inventory control (EOQ Model, ABC, VED, FSN analysis) Modelling (Classification of inventory, Deterministic versus Stochastic problems situations, Formulation and solution of Deterministic inventory problems) Operations Research (Linear Programming, and solutions in such cases as Integer Programming Problems (IPP), Transportation problem (TP) and Assignment Problem (AP)) PERT & CPM. Network Analysis - PERT (Assumptions and computations related to PERT mode) & CPM (Crashing of jobs for minimum cost-time schedule for CPM models) Maintenance Management - Meaning and Types of maintenance, and their suitability, Standards of maintenance, Total Productive Maintenance (TPM).
9	Fluid Mechanics	Fluid Mechanics: Bernoulli's Theorem and its important applications, Viscosity, Co-efficient of Viscosity. Streamline and Turbulent flow, Reynolds Number, Critical velocity, Poiseuille's equation for flow of liquid through a tube, Motion of a Rigid body in a viscous medium, Rotational Viscometer Pressure and Fluid Statics, Kinematics of Fluids Dynamics of Fluid Flow Flow through pipes Compressible Flow Viscous Flow Turbulent Flow
10	Thermodynamics & Power Engineering	Basic Thermodynamics, Laws of Thermodynamics, Properties of steam, Air standard cycles, Fuels and Combustions Boiler Basic Steam Power Cycles Steam Nozzles, Steam Turbines, Steam Condensers Concepts of regeneration and reheat and I.C Engines: Air-standard Otto' Diesel Air & Gas Compressors Gas Turbine Basic of Blower Psychrometry
11	Turbo machinery	Eular equation for turbo, Impulse turbine- Pelton wheel, Reaction Hydraulic turbine- Franci's turbine; Centrifugal Pump and Reciprocating Pump; Fluid System - Fluid couplings, Hydraulic dynamometer, Gear Pumps.
12	Heat Transfer	Modes of Heat Transfer, 1-D heat conduction, heat transfer through fins, unsteady heat conduction, lumped parameter system, Heisler's charts, Thermal Boundary layer, Dimensionless parameters in freed forced convective heat transfer, heat transfer correlations for flow over flat plates & through pipes, effect of turbulence, Heat exchanger performance, LMTD & NTU method, Radiative heat transfer, Stefan Boltzmann law, Wein's Displacement Law, Black & Grey Surfaces, View factors, Radiation Network Analysis.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (INFORMATION TECHNOLOGY)

[POST CODE – (IT 09)]

Sl.No	Topic	Particulars
1	Digital Systems & Microcontrollers and Applications	Fundamentals of Digital Systems and logic families Combinational Digital Circuits Sequential circuits and systems A/D and D/A Converters Semiconductor memories and Programmable logic devices. Fundamentals of Microprocessors The 8051 Architecture Instruction Set and Programming, Addressing modes. Memory and I/O Interfacing
2	Data Structure and Algorithms	Stacks and Queues Arrays, Linked Lists Searching, Sorting and Hashing Graph and Tree Algorithms Design and analysis of Algorithms Tractable and Intractable Problems Time Complexity, Space Complexity
3	Computer Organization and Architecture	Functional blocks of a computer Introduction to x86 architecture and instruction set, RISC, CISC Pipelining Memory organization Basics of Intel and AMD Processors Organization and Architectural Techniques Memory Hierarchies Peripheral Devices Instruction Level, Thread Level & Process Level Parallelism
4	Operating System	Introduction to OS Process Management Inter-process Communication Deadlocks, Mutex, Semaphores Memory Management techniques I/O devices OS Protection and Security
5	JAVA / C# / Python Programming	Principles of Object-Oriented Programming Basics of Java/C#/Python language Working with User Interfaces Introduction to Threads in Java Database connectivity using JAVA / C# / Python
6	Database Management System	Database System Architecture Relational Query Languages, Relational Database Design, Query Processing and Optimization Storage Strategies Transaction Processing Database Security ACID Properties Normalization and Joins DDL, DML, DCL, DQL, TCL
7	Formal Language and Automata Theory	Finite Automata and Regular Expressions Context-Free Grammars (CFG) Turing Machines Regular & Context-Free Languages Applications of Formal Languages and Automata Theory

Sl.No	Topic	Particulars
8	Computer Graphics	Display Devices Output Primitives Geometric Modelling Two-Dimensional Viewing, 3-D Concepts Visible Surface Detection Methods
9	Compiler Design	Syntax Analysis (Parser) Semantic & Lexical Analysis Intermediate Code Generation Type systems Error detection and recovery
10	Computer Networks	Data communication Components OSI Model & TCP/IP Model Switching and Routing Subnetting Network Security & Firewalls Fundamentals of Wireless Networks SDN
11	Data Mining and Big Data Analytics	Data Cleaning and Processing Association and Correlation Analysis Clustering Algorithms and Cluster Analysis Classification Introduction to Big Data Introduction to Big Data Applications Introduction to Big Data Applications using machine learning. Introduction to Analytics engines like Spark, Hadoop MapReduce etc.
12	Software Engineering	Software Development Process Software Requirement Gathering System Design Principles Software Testing and Quality Management Software Project Management
13	Cloud Computing	Introduction to Cloud Computing Cloud Architecture and Virtualization Serverless Computing and Microservices Basics of popular Cloud Providers: AWS, Azure, GCP
14	Principles of Programming Languages	History & Classification of programming languages Data Abstraction and Data Structures Syntax and semantics of programming languages Types in programming languages Programming Language Evaluation (features/design/implementation)
15	Machine Learning	Introduction to Machine Learning Supervised and Unsupervised Learning Ensemble and Probabilistic Learning Reinforcement Learning and Evaluating Hypotheses Genetic Algorithms Deep Learning Techniques
16	Distributed Systems and Parallel Computing	Concepts and characteristics of distributed systems Distributed algorithms and protocols Distributed Database Systems Parallel processing architectures Basics of Parallel programming & Parallel algorithms Distributed Systems Security
17	Embedded Systems and Internet of Things	Embedded systems and their applications Real-Time Operating Systems Embedded Software Development Basic IoT concepts Interoperability in IoT Data Handling and Analytics Fog Computing

Sl.No	Topic	Particulars
18	Cryptography	Symmetric Ciphers -Overview Public Key Encryption, Digital Signatures Authentication Protocols System Security
19	Artificial Intelligence	Scope of AI Problem solving - State space search, Production systems, search space control. Knowledge Representation-Predicate Logic Handling uncertainty and learning non-Monotonic reasoning Neural Networks Planning and Constraint Satisfaction Swarm Intelligence Image processing Natural Language Processing
20	Web Development	HTML, CSS, JavaScript HTTP Methods, Request/Response Headers, Storage Mechanisms – Local, Cookie, Session Server-Side Programming – NodeJS / Java / Python / C# CRUD Operations REST APIs, Rate Limiting, Authorization and Authentication

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (ELECTRONICS & COMMUNICATION)

[POST CODE – (E&C 10)]

Sl.No	Topic	Particulars
1	ENGINEERING MATHEMATICS	Linear Algebra Calculus Differential Equations Vector Analysis Complex Analysis Probability and Statistics
2	BASIC ELECTRICAL ENGINEERING	DC circuits: Electro-magnetism: Single-phase AC circuits Transformers and efficiency Basics- DC machines Electrical power sources Basics of cell, batteries and their uses Basics of Electrical Installations
3	ELECTRONIC DEVICES	Semiconductor Physics P-N junction Basics of semiconductors Diodes Junction & Field Effect Transistors Power Switching Devices Optoelectronics
4	NETWORKS, SIGNALS AND SYSTEMS	Circuit Analysis Continuous-time Signals Discrete-time Signals LTI systems
5	ANALOG CIRCUITS	Simple diode circuits Single-stage BJT and MOSFET amplifiers BJT and MOSFET amplifiers Simple op-amp circuits Sinusoidal oscillators Power supplies
6	DIGITAL CIRCUITS	Number Representation Combinatorial circuits Logic Gates Logic Families Semiconductor Memories Sequential Circuits Data Converters Computer Organization
7	COMMUNICATION SYSTEMS	Random Processes Analog Communications Information Theory Digital Communications Optical Communication Cellular Networks

Sl.No	Topic	Particulars
8	CONTROL SYSTEMS	Basics of Control Systems Feedback systems Transfer function Block diagram representation Signal flow graph Transient and steady-state analysis of LTI systems Frequency response Routh-Hurwitz and Nyquist stability criteria Bode and root-locus plots Lag, lead and lag-lead compensation State variable model and solution of state equation of LTI systems Design of control systems, compensators, elements of lead/lag compensation, PID and industrial controllers.
9	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	Principles of measurement Analog and Digital systems for measurement Electromagnetic Instruments Electronic Instruments Measurement systems for non-electrical quantities Basics of telemetry Different types of transducers and displays Data acquisition system basics
10	COMPUTER ARCHITECTURE, PROGRAMMING, NETWORKING	Basics of Programming Object Oriented Programming Basics Basic Data structures Overview of data communication and Networking OSI reference model
11	ADVANCED ELECTRONICS TOPICS	DSP: Discrete time signals/systems, uses Digital filters Transmission lines Microprocessors & microcontrollers Basics of Embedded systems

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (PETROLEUM)

[POST CODE – (PE 11)]

Sl.No	Topic	Particulars
1	Petroleum Geology	Geology of Petroleum – An Overview: Gravity methods of prospecting Stratigraphy & micro- paleontology: Structure, tectonics, and basin evolution: Source Rock Reservoir rock Petroleum Province: Geographic and geologic distribution of oil and gas field in India with special reference to northeast India
2	Geophysical Exploration & Prospecting	An overview of Exploration Geophysics Gravity methods of prospecting Magnetic methods of prospecting Electrical methods of prospecting Well logging Techniques of well logging (Types & Basic Principles) Log Interpretation Introduction to VSP Advances in Logging tools
3	Drilling Technology	Introduction to oil well drilling & Drilling process analysis. Subsurface conditions, pressure relations within formation and well bore, geomechanics, and fracture pressure. Drilling fluids, Chemistry & well control fundamentals. Drill string, Casing & Cementing Basic well planning: data acquisition and analysis, drilling program. Drilling optimization Directional drilling Drilling complications Air and gas drilling Drilling Services & automation, optimizing rate of penetration. Clay Mineralogy& Rheology of Drilling Fluids The Filtration properties of Drilling Fluids Practical Implementations and innovations in drilling fluids Cement Slurry
4	Fundamentals of Reservoir Engineering and Reservoir Rock & Fluid Properties	Introduction to Petroleum Reservoirs Reservoir Fluids and Phase Behaviour Reservoir Rock Properties: Porosity; Permeability; Fluid saturations. Wettability Fluid Flow in Reservoirs and Reservoir Rock-fluid Interactions Reservoir Drive Mechanisms Estimation of Petroleum Reserves Core analysis & Core preparation Crude oil and formation water analysis
5	Natural Gas Engineering	Introduction to Natural Gas Engineering Wellbore and Choke performance Gas flow measurement and fundamentals Importance of Unconventional Gas Reservoirs Natural Gas as an Alternative Fuel
6	Flow through porous media	Introduction Single-phase flow in porous media Multi-phase flow in porous media Effective properties of porous media Injection well location sweep Efficiency for pattern flood Displacement mechanisms Fluid flow in reservoirs Theories Modelling & Simulation

Sl.No	Topic	Particulars
7	Production Technology	Introduction to Oil Recovery methods: Well Completion Design Well Activation methods. Performance Evaluation Flowing well performance Well stimulation Techniques. Artificial Lift methods
8	Exploration and Development of Oil & Gas Fields	Petroleum exploration methods Well prognosis and economic analysis: Principles of development of oil & gas fields Processing and integration of geological and geophysical data: Concept of sequence stratigraphy and its application in Petroleum Exploration Unconventional hydrocarbon system Future hydrocarbon exploration in India with special reference to Assam-Arakan Basin/ / NE India
9	Geophysical Exploration and Data Processing	Electromagnetic methods of prospecting Elasticity and seismic waves Basic concepts of seismic methods Seismic data acquisition
10	Applied Reservoir Engineering	Flow Equations Oil well Testing Gas Well Testing Water Influx Immiscible Displacement Integrated Reservoir Management Reservoir Simulation
11	Surface Production Operations	Surface gathering system. Gas processing Liquid processing Surface handling of gas, oil and water Flow assurance Sand control
12	Enhanced oil recovery	Introduction Water injection Immiscible displacement Miscible drive Thermal recovery methods Chemical recovery methods Other methods Development of images Designing flow parameters
13	Health, Safety & Environment (HSE) and Risk Management (RM)	Introduction Health hazards in Petroleum Industry Safety Environment Principles of risk management Application of risk management Application of risk management in Upstream Oil Industry
14	Well Servicing	Sick well Work over operations &equipment Work over fluids Well Intervention Lab work/Practical
15	Oil Well Production Technology	Basics of Petroleum Geology Well Completion Design Well performance Artificial Lift methods Surface production operations

Sl.No	Topic	Particulars
16	Petroleum Geoscience	Overview on Petroleum system (Source rock, reservoir rock, cap rock) Origin, migration and accumulation of petroleum Rock Eval Pyrolysis analysis. Maturation of source rock (TimeTemperature Index). Types and distinguishing properties of reservoirrocks & fluids Reservoir Trap- types and genesis Concept of life cycle of an oilfield Different reservoir drive mechanisms and their effect on hydrocarbon recovery Enhanced Oil Recovery (EOR) techniques Sandstone diagenesis and its effects on reservoirproperties Clay mineral types and its impact in reservoirrock Principles and application of wireline logs in reservoir studies Brief overview on types and occurrence unconventional hydrocarbon resources Geographic and geologic distribution of oil and gas field in India with special reference to northeast India Overview on role of regulatory bodies on E&P business in India (i.e. NELP/HELP etc.)

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR GEOLOGIST

[POST CODE – (Geo 12)]

Sl.No	Topic	Particulars
1	Structural Geology	Introduction to Rock Mechanics Folds, Faults and joints Shear zones Unconformities Basics of Experimental Structural Geology Constitution of the Earth's Interior Plate Tectonics Structure &Tectonics of India
2	Stratigraphy	Modern development in stratigraphy Formal stratigraphic classifications Stratotypes, Global Boundary Stratotype Sections and Points (GSSP), Facies in stratigraphy. Walther's Law of succession of facies. Types of Stratigraphic facies. Methods of Correlation Sequence Stratigraphy Accommodation Space Controls (3 S's) - Subsidence (tectonics and compaction); Sea Level (Eustasy); Sediment (rates and climate) Basic terms: systems tracts, sequences, sequence boundaries, maximum flooding surfaces, parasequences, flooding surfaces, the Vail Curve. Seismic stratigraphy: Development of the concepts and their significance. Introduction to Quaternary Geology and its applications. Earth's Climatic History Pleistocene Glacial-Interglacial cycles. 1. Geology of Indian Peninsula. Tectonic evolution of cratons and mobile belts in peninsular India. Introduction to important Hadean, Archaean, Proterozoic successions of Indian Peninsula: Dharwar,Singhbhum Cratons and Shillong Plateau. Proterozoic stratigraphy of CudappahVindhyan and Delhi basins. 2. Distribution, Stratigraphy, Classification and Sedimentation of Gondwana sequence of India. Palaeogeography and Palaeoclimates during Gondwana Times. Distribution of Gondwana equivalents in other continents. 3. Stratigraphy and distribution of Triassic rocks of Spiti, Jurassic rocks of Kutch and Cretaceous rocks of Meghalaya and Cauvery Basins. 4. Volcanic provinces of India. Deccan Volcanics : Stratigraphy and Distribution and age. 5. Stratigraphy and Distribution of Tertiary rocks of upper Assam and Surma basins, Assam Arakan Mobile Belt, Meghalaya Basin and Arunachal foredeep. 6. Geology of Himalayas: Physiographic and lithotectonic subdivisions of the Himalaya. Major thrusts and their boundaries. India & Asia collision. Lithological characteristics of subdivisions of the Himalaya. Sedimentation and evolution of Himalayan foreland and intracratonic basins.Palaeozoic, Mesozoic and Cenozoic succession of the Himalayas. Stratigraphy of the Siwalik Group.

Sl.No	Topic	Particulars
3	Igneous and Metamorphic Petrology	Definition of Magma, Constitution of Magmas, Generation of Magmas, source rock composition: upper mantle and lower crust, evolution of magma Application of major and trace elements in petrogenesis, construction of variation diagrams, classification of trace elements, Rare earth elements and their applications to petrogenesis. Classification of magmatic rocks-based on fabric, field relations, mineralogical and modal, and whole rock compositions, IUGS classification of plutonic, hypabyssal and volcanic rocks, Irvine- Baragar classification of volcanic rocks,classification of basalt, igneous rock names, chemical discriminants of rock types. MELT programme. Crystallization of basaltic and granitic magmas: Mid oceanic ridge volcanism, continental flood basalts, Deccan basalts, basalt magmatism associated with subduction zone. Heat flow and magma generation: (mantle plume /hot spots; large igneous provinces). Role of fluids in magma generation. Concept of mantle metasomatism and enrichments in lithospheric peridotites Igneous rocks of oceanic regions: Oceanic spreading ridges and related basaltic rocks, mantle plumes and oceanic island volcanic rocks, plume heads and flood basalt plateau lavas, arc magmatism, oceanic island arcs. Other associations: Igneous rocks associated with convergent plate boundaries, continental flood basalt and large igneous provinces,large layered igneous complexes, continental alkaline rocks, ultra-alkaline and silica poor alkaline rocks, alkaline cratonic associations, ophiolite, granites and granites, continental rift associations.
4	Geomorphology and Seismology	Basic concept of Geomorphology, Control of geomorphological features by geological structure, lithology & Climate. Physical, chemical, and biological processes in weathering, Soil profiles and nomenclature of horizons, Classification of soils, Role of soil in geomorphology. Mass movement and hillslope evolution, Classification of mass movements. Fluvial system, drainage basin and networks, River and channel geometry, Longitudinal profile of river, Fluvial erosion, transportation and depositional processes and related landforms. Morphometric analysis of basins. Concept of basin morphometry. Laws of drainage composition. Linear aspects aerial aspects , relief aspects Geomorphic Landforms: Glaciers Types of glaciers, Movement of glacier. Glacial landforms Formation of deserts, desert characteristics Eolian processes and landforms. Energitics of shore-zone processes – waves, tides and currents. Coastal landforms. Coastal submergence and emergence-shoreline development. Quaternary geomorphology, Cycles of climatic changes and landforms. Geomorphological subdivisions of Indian subcontinents, Tectonic Geomorphology: Concept, topographic markers and geomorphic indices of active tectonics. Active tectonics and rivers.

Sl.No	Topic	Particulars
5	Geological & Geochemical Exploration	Mineral Exploration and Exploration Geology Exploration Philosophy and Principles. Stages and norms of exploration. Geological techniques and procedures of exploration. Geological criteria and guides to mineral search. Geological mapping phases and types. Sampling methods and ore reserve estimation. Exploration of important economic mineral deposits. Exploration case histories. Study of geological maps and sections, stratigraphic columns, structure contour maps, isopach maps, facies maps. Exploratory drilling – brief reviews of different drilling methods, planning, selection of sites, core logging and records. Geological documentation of exploratory works The earth in relation to the Universe. Earth as Physico- chemical system. Geochemical cycle. The Geochemical classification of elements. Geochemical evolution of the earth. A short account of geochemical processes in relation to magmatism, sedimentation and metamorphism. Special properties of trace and REE elements. Radioactive isotopes and their application to geochronology and petrogenesis. Stable isotopes and their application to earth system processes. Geochemistry in Mineral exploration. Geochemical dispersion, mobility, association of elements. Various prospecting methods for geochemical rock sampling, soil, water, drainage, biogeochemical and geobotanical surveys and a brief description of geochemical anomalies developed in it. A short account of geochemical aspects of coal and petroleum. Geochemical methods of hydrocarbon source rock analysis.
6	Remote Sensing	ce curve. Aerial photography: Photographic flight planning, Aerial camera, film and filters. Geometric characteristics of Aerial photographs : Geometry of vertical aerial photographs. Terminology. Tilt and image displacement. Stereoscopic parallax, stereoscopy and vertical exaggeration Aerial photographs in field mapping and preparation of photogeological maps. Working principles and use of simple photogrammetric instruments. Methods of quantitative determination of height, dip of bed, stratigraphic thickness and throw. Remote sensing sensors and platforms. Remote sensing data products, Concept of Digital Image Processing - Geometric and radiometric corrections. Principles of photo interpretation. Elements of photo interpretation : Scale, tone, colour, texture, pattern, shape, size. Drainage patterns, Drainage anomaly Applications: Photogeological Techniques in lithological and structural interpretation. Application of photogeological interpretation in mineral exploration, engineering geology and ground waters studies. Geological features identification from Remote Sensing Techniques. Space Missions : Global and Indian space mission LANDSAT, METEOSAT, SEASAT. SPOT, IRS. GIS – Concepts, components, data formats and structure.

Sl.No	Topic	Particulars
7	Palaeontology	Organic life, fossil Introduction to Taphonomy, Organic evolution & General principles of palaeontology Microfossils Morphology and geological distribution of Foraminifera Radiolaria Ostracoda. Palaeoenvironment interpretation with these microfaunas Introduction to Palynology Palynological guide fossils of India Morphology and geological distribution of Spores and pollen grains Dinoflagellates Calcareous algae Diatoms Acritarchs, Calcareous nannoplankton (coccoliths) Palynodebris and palaeoenvironment interpretation with these microorgainsms Cretaceous-Palaeocene-Eocene microfossil assemblages of Assam, Meghalaya and Arunachal Pradesh and their age and environmental significance Application of microfossils (fauna and flora) in a. Hydrocarbon exploration b. Palaeooceanographic interpretation c. Climate change interpretation Oxygen and Carbon Isotope studies of microfossils. Introduction to Biofacies, Microfacies and Palynofacies Biostratigraphy and biostratigraphic zonation Biomineralization Ultrastruture Biomarker Palaeobiogeography Palaeoecology, Life habitats and various ecosystem.
8	Non-conventional Energy	Components of Energy : Non-Renewable and Renewable Production of Thermal energy using fossil fuels and solar energy Geothermal and Tidal Energy: Basic principles, Systems used in practice and applications Resource assessment.
9	Geoscientific Data Analysis with Matlab and Petrel	Introduction to Matlab Image processing using Matlab Signal processing using Matlab Simulation, regression, classification and optimization Reservoir modeling using Petrel.
10	Sedimentology	Condition of sedimentation on the earth surface Origin and occurrence of siliciclastic, carbonate sediments and other chemical/biochemical sedimentary rocks. Physical processes of sediment movement and sedimentation Sedimentary textures and structures. Use of textures and structures in interpreting depositional conditions. Classification of sedimentary rocks: classification of conglomerate, sandstones, mudstone and carbonate rocks Sedimentary environments, facies association and models for major environments. Palaeocurrent analysis, heavy minerals analysis. Sedimentary Facies and Sequence Analysis. Provenance of siliciclastic sedimentary rocks Diagenesis of sandstones, mudstone and carbonate rocks. Sedimentation and Tectonics: Classification of tectonic basins, sandstone composition and basin evaluation. Application of Stable isotopes in sedimentological studies.

Sl.No	Topic	Particulars
11	Geochemistry: Principles & Applications	The Elements and the Periodic Table, Chemical bonding, Geochemical classifications, The atomic nucleus and isotopes. Basics, Methods for analysis, Major and minor elements in the crust, Normative minerals, Variation diagrams. Basics, Element distribution, The rare earth elements: a special group of trace elements, Isotopes: radioactive & stable. The chemical composition of magmas and igneous rocks, variation diagrams to model magmatic evolution, sedimentation as a geochemical process, the chemical composition of sedimentary rocks, the chemical composition of metamorphic rocks, material transport during metamorphism. Carbon cycle, origin composition and structure of organic matter, Optical and geochemical methods for source rock characterization and maturation assessment.
12	Essentials of Earth Science	Mineral: definition, types and examples. Rocks and the rock cycle, Vulcanicity and Igneous rocks, Sedimentary rocks and Metamorphic rocks. Fossils. Deformation of Rocks: Folds, shear zones, faults and lineaments Earthquake and Earthquake belts of the world, Plate tectonics, Fold and Thrust belts, Concept of Sedimentary Basins. Introduction to energy resources. Fossil fuels, Source, migration and reservoirs and trapping of petroleum. Important oil fields of India. Economic minerals / Water Resource Basic concept of Geomorphology, Surficial Processes and landforms – Fluvial, Glacial, Aeolian, Coastal Geomorphology of Brahmaputra valley Geological time scale Climate change through Geological History Factors influencing climate change.
13	Petroleum Micropalaeontology	Micropalaeontology Petroleum Geosciences Geology of Petroliferous Sedimentary Basins
14	Fluvial Geomorphology	Meaning, scope and evolution of fluvial geomorphology Fluvial system, Fluvial regime Modern methods and techniques in fluvial geomorphological studies: Remote sensing, GIS and computer applications. Drainage basin as a fluvial system: inputs and outputs in the basin, drainage basin as a fundamental geomorphic unit. Channel process: forces acting in channel, flow types, velocity distribution, water and sediment discharge, channel erosion and deposition. Channel patterns: Straight, meandering, anabranching and braided. Geometry of meanders, development and causes of meandering, mechanics and causes of braiding. River channel changes, channel metamorphosis, misfit stream. Flood geomorphology: flood as geomorphic agent, flood frequency analysis, recurrence interval. Paleoflood analysis. Fluvial geomorphology of the Brahmaputra Valley. Channel Morphology of the Brahmaputra river Active tectonics and alluvial rivers.

Sl.No	Topic	Particulars
15	Isotope Geochemistry	The origin of isotope geology. Isotopes and their impacts in geology, cosmic abundance of elements and characteristics. Stable isotopes and their fractionation. Radioactive decay and growth. Decay of radioactive parent to a stable daughter. Decay series. Nuclear fission. Units of radioactivity and dosage. Neutron activation. Mass spectrometry, Type, Isotope dilution analysis. Principles and procedures of the following radioactive dating methods. K-Ar dating Rb -Sr dating. Sm-Nd dating U-Pb dating. Fission Track dating. Isotope geology of Ar, Sr & Nd Oxygen and Hydrogen isotopes and their application Isotope geochemistry related to petrology Evolution of isotopic reservoirs in mantle and crust.
16	Elements of GIS	Introduction and definitions of GIS , components, application areas of GIS, advantages and disadvantages of GIS Data formats, Data structure, Raster data model and vector data model, Raster versus vector, Advantages and disadvantages of raster and vector Functional elements of GIS: Data acquisition, Data input and data processing, data management system, product and report generation Concept of database and DBMS Coordinate systems: Cartesian Coordinate System, Geographic Coordinate system Map Projection: Definition, Classification and types map projection, Polyconic projection, UTM projection, Latitude/Longitude geographic coordinates Digital Image processing and GIS softwares (ArcGIS, ERDAS)

Sl.No	Topic	Particulars
17	Geophysical Exploration	Scope of the subject in relation to hydrocarbon, mineral and ground water exploration. Geophysical properties of rocks and minerals. **Field theory:** Newtonian potential; Laplace and Poisson's equations; Green's Theorem; Gauss's law; Continuation integral; equivalent stratum; Maxwell"s equations and electromagnetic theory; Displacement potential, Helmhotz's theorem and seismic wave propagation. **Elements of inversion:** What is inversion theory? What are the goals of inverse analysis? Examples of forward problems like fitting a straight line, a parabola; tomography; convolution etc. Matrices and Linear Transformations, Probability and Statistics **Electrical methods of surveying.** Surveying natural potentials : Exploring shallow natural potentials, Telluric currents, Telluric current surveying, Magneto telluric surveying, Field examples. Electromagnetic surveying : The principle of EM surveying, parallel line dip angle EM surveying, Horizontal-loop EM surveying, Airborne EM surveying, Field examples. Induced polarization surveying : Source of induced potential, Measuring induced potentials, Results of IP surveying, Field examples. Electrical resistivity surveying : Ohm's law and resistivity, current flow in three dimensions, current density, current flow across a boundary, Measuring resistivity, Equipment for electrical resistivity surveying, Sounding and profiling, Forward and Inverse methods of resistivity data interpretation. The methods of characteristic curves and use of computer softwares, Resistivity profiles over faults and dykes, Resistivity and lithology. **Numerical analysis and inversion:** Gravity and Magnetic methods: General principles, General principles behind the instrumentation, zero length spring and Warden gravimeter, Proton precession magnetometer, Field procedures, Corrections, General discussion on interpretation, case histories. Reflection and Refraction methods: Different types of seismic waves, Acoustic impedance, Reflection & Refraction coefficients, Signal and Noise, Raypath seismology for two layered earth-horizontal and dipping. Geophones, General discussion on data acquisition, processing and interpretation, VSP. Different types of logging techniques: Application of the geophysical logging techniques in Ground Water, Minerals and Hydrocarbons. 2D/3D surveying and its application. Reservoir properties & Petrophysics of rocks, Basic concept of Log interpretation, General familiarity with different types of logging tools and their responses.

Sl.No	Topic	Particulars
18	Petroleum Geology	Introduction to Petroleum Geology Mode of occurrences of petroleum: Surface, subsurface and Miscellaneous Physical and chemical nature of petroleum. Organic/Inorganic Origin of petroleum Migration and accumulation of Petroleum. Source rocks, Source Rock Evaluation, Rock Eval pyrolysis Conversion of organic matter into Petroleum Reservoir fluids : Gas, Oil and Water Clastic and non-clastic reservoir rocks Trapping Mechanism for Oil & Gas: Structural, Stratigraphic and Combination traps. Concept of petroleum bearing basins and basin geology. Petroliferous basins of India Petroleum Geology of India and world Geology of major oil and gas fields of India. Future trends of oil exploration. Details study of oil-gas fields of NE region. World oil and gas reserves. A brief review of the important oil fields of the world.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (HR)

[POST CODE ţ (HR 13)]

Sl No	Course Title	Syllabus
1	Principles and Practices of Management	Development of management Thought, Contributions of Taylor, Fayol, Mayo, Mary Parker Follett and C.I. Barnard. Behavioural Approach, Systems Approach, Quantitative Approach and Contingency Approach. Function of Management: Planning and Decision Making, Organising, Staffing, Directing, Controlling, Coordinating.
	Human Resource Management	Conceptual framework, Human Resource Planning, Job Analysis, Recruitment, Selection, Placement, Induction, Training and Development, Performance Management, Job Evaluation, Compensation Management, Employee Benefits and Incentives, Managing Career. New Trends in HRM: Changing environment of HRM and contemporary challenges, Emerging HRM Concepts.
3	Human Resource Development (HRD)	Concepts, Assumptions, Values, HRD Mechanisms, Action – research Model, HRD Culture and Climate, HRD Interventions, HR Accounting and Audit, Consultant – client relationship, Knowledge Management, Human Resource Information System. International Human Resource Management (IHRM): Organisational context of IHRM, IHRM and Sustainable Business, Functions of IHRM, Cross – Cultural Studies, Cultural Diversity, Transnational Organisations, IHRM models.
4	Organisational Behaviour	Concept, Scope, Nature of human behavior, Personality, Perception, Learning, Attitude, Motivation, Interpersonal Behaviour, Group Dynamics, Leadership, Communication, Power and Authority, Stress management, Organisational Change and Development.
5	Industrial Relations	Concept, Scope, Evolution, Approaches, Actors and Models, Conflict and cooperation, Bi-partitism, Tri-partitism, Collective Bargaining, Workers' Participation in Management, Grievance Handling and Disciplinary Action, Code of Conduct, Industrial Relations in changing scenario, Employers' organisations. Trade Unions: Concepts, Evolution, Problems of trade unions in India, Recognition, The Trade Unions Act, 1926. Emerging role of trade unions in India
6	Industrial Disputes	Factors, Forms, Trends, Prevention and Settlement, Role of State and Central Labour Administration, Strikes and Lockouts. The Industrial Employment (Standing Orders) Act, 1946. The Industrial Disputes Act, 1947.
7	Labour Legislation	• Objectives, Principles, Classification and Evolution. International Labour Organisation, Social Justice and Labour Legislation, Indian Constitution and Labour Laws. • The Factories Act, 1948. • The Mines Act, 1952. • The Inter-state Migrant Workmen (Regulation of employment and conditions of service) Act, 1979. • The Contract Labour (Regulation and Abolition) Act, 1970. • The Building and other Construction workers (Regulation of employment and conditions of service) Act, 1996. • The Child Labour (Prohibition and Regulation) Act, 1986. • Maternity Benefit Act, • PoSH Act • RPwD Act

Sl No	Course Title	Syllabus
8	Wages	Concept, Types, Factors influencing wages, Wage Theories and Wage Differentials: • The Minimum Wages Act, 1948. • The Payment of Wages Act, 1936. • The Payment of Bonus Act, 1965. • The Equal Remuneration Act, 1976. • The Payment of Gratuity Act, 1972. • The Employees' Provident Fund and Miscellaneous Provisions Act, 1952.
9	Labour Welfare	Concept, Scope, Types, Theories and Principles, Industrial Health and Hygiene, Industrial Accidents and safety, Occupational Diseases Social Security: Concept and Scope, Social Assistance and Social assurance.
10	Labour Market	Features, Demand and Supply of Labour, Nature and Composition of Indian Labour Force, Unemployment and Underemployment, Types of Labour Market, Characteristics of Indian Labour Market, New Dynamics of Labour Market in India, Economic Systems and Labor Market, Problems of Labour in India.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

SENIOR OFFICER (HSE)

[POST CODE ţ (HSE 14)]

SL. No	Course title	Syllabus
01	Environmental Chemistry	• Fundamentals of Environmental Chemistry. • Principles of Water Chemistry. • Soil Chemistry. Atmospheric Chemistry.
02	Environmental Microbiology	• Prokaryotic and Eukaryotic Microorganisms; Characteristics & Classification; Plant-microbe and soil-microbe interactions; Role of microorganisms in wastewater treatment and bioremediation. • Microbial Metabolism. • Growth and Control of Microorganisms. Microbiology and Health.
03	Water Resources	• Global Water Resources. • Surface Water Resources. Groundwater Resources.
04	Water & Wastewater Treatment and Management.	• Water and wastewater quality parameters; Eutrophication and thermal stratification in lakes; River pollution - Oxygen sag curve. • Water treatment methods. • Point and non-point sources of wastewater; Population forecasting methods; Design of sewer and storm water sewers; Sewer appurtenances; Preliminary, primary, secondary and tertiary sewage treatment; Sludge generation, processing and disposal methods; Sewage farming. • Sources and characteristics of industrial effluents; Concept of Common Effluent Treatment Plants (CETP); Wastewater recycling and zero liquid discharge. • Kinetics and Biological reactor design.
05	Air and Noise Pollution	• Structure of the atmosphere; Natural and anthropogenic sources of pollution; Atmospheric sources, sinks, transport; Indoor air pollution; Effects on health and environment; Air pollution: gases and particulate matter; Air quality standards; Primary and secondary pollutants; Criteria pollutants, ambient and source standards, air quality indices, visibility. • Particulate Pollutants. • Gaseous Pollutants. • Automotive emission controls, fuel quality, diesel particulate filters, catalytic convertors. • Air Quality Management. • Noise pollution. • Instrumentation Techniques for Environmental Monitoring.
06	Solid and Hazardous Waste Management	• Integrated solid waste management; Waste hierarchy; Rules and regulations for solid waste management in India. • Municipal solid waste management. • Hazardous waste management • Soil contamination and its remediation • Leachate contamination into groundwater and its prevention & treatment. Management of Biomedical waste, Plastic waste, E-waste, Construction & Demolition Waste.
07	Global and Regional Environmental Issues.	• Global effects of air pollution – Greenhouse gases, global warming, climate change, urban heat islands, acid rain, ozone hole. • Environment conventions and protocols. Principles of International Law and International treaties.

SYLLABUS FOR WRITTEN EXAM FOR THE POST OF

CONFIDENTIAL SECRETARY

[POST CODE ţ (CS 15)]

Sl No	Course Title	Syllabus
1	TYPING	• Methods of typing, • Centering • Typing of letters, blocked, semi blocked and NOMA simplified with open closed and mixed punctuations, • Typing of addresses on envelopes, inland and postcards including window display chain feed. • Typing of annexure and appendices to letters. • Tabular typing Correction of errors on the carbon copies • Typing on printed forms • Typing from recorded tapes • Personal habits and work habits, personal appearance, willingness, promptness, initiative, trustworthiness, punctuality, etc. Following instructions/directions.
2	SHORTHAND ENGLISH	• Introduction to Shorthand, Consonants: Definition, Classification, arrangements and directions, table of consonants, Joining of Strokes • Vowels: Long & Short Vowel, Dot & Dash Vowel, Places of Vowel, following and preceding vowel, Intermediate vowel, places for joined strokes & vowel. • The Consonants, the Vowels, Intervening Vowels and Position, Grammalogues, Punctuation, Alternative signs for `r' and `h'. • Dipthongs and abbreviated `W'. Phraseography including tick 'the'. • Representing `S' and `Z' with circle and strokes, large circles `sw' and `ss' or `sz'. Loops `ST' and `STR', initial hooks to straight strokes and curves, `n' and `f' hooks, alternative forms for `fr' and `vr' etc. with intervening vowels. Circle and loops to final hooks, the shun hooks. The aspirate, upward and downward 'r', upward and downward 'l' & 'sh', compound consonants, vowel indication. The halving principle, the doubling principle, dipthonic or two vowel signs, medial semicircle. Prefixes and negative words, suffixes and terminations. Special list of words. • Contraction, Special Contractions, Figures, etc, Proper Names, etc., Essential Vowels, Intersections, Advanced Phraseography. Different Phrases- Business, Political, Banking & Stock Broking, Insurance and Shipping, Technical & Railway, Legal etc.

Sl No	Course Title	Syllabus
3	OFFICE MANAGEMENT	• Importance of Filing and its various kinds of proformas used in organizations and institutions. • Office-Introduction, Importance of Office, Departments of Office. Functions, Duties and Characteristics of Office Manager.Office Accommodation and Environment - Office building : size, layout, safety and security measures - Reception : Importance, shape and size, control - Communication : Feature, classification, barriers. - Arrangement and adjustment: Furniture, allotment of seats, chambers, cabins rooms etc. - Handling of correspondence and market registers, filling forms and stationery. Office Layout-Types of Office Layout, Open and Private Office. • Office Machines, manuals, charts and reports - Kind of office machines (Computers and word processors), calculators, etc. - Objectives and advantages of various machines. - Use of machines, installing, handling, maintenance. - Objectives and advantages of office manuals charts, preparation and play of manuals and charts. - Kind of reports, report preparation, enquiries. • Office Equipments: Types of Office Equipment and Mailing Room Equipments. Photocopier and Communicating Equipments. Other useful equipments – Duplicating Machine, Intercom, EPBX, Electronic Stencil Cutter, Personal Computer, Internet Fax, Zerox etc. Networking - LAN, MAN, WAN Using internet, sending and receiving e-mail messages; searching, Information from websites by the use of search engines. • Personnel Management, Supervision, Control and coordination - Office staff (Peon, daftari, clerk, technical staff, supervisors, accountant, manager, etc.) Selection, training and development - Supervision: Importance and span of supervision-Discipline: Importance and manner of office control, work control and work distribution.
4	**SECRETARIAL PRACTICE**	• Secretary: Roles and responsibilities, definition, need and importance, appointment and dismissal, work, duties, rights and liabilities, memorandum of association and secretary, articles of association and secretary, prospectus and secretary. • Company management and administration: Definition, importance and kinds, directors: qualification and number, appointment, removal, powers, duties and liabilities, remuneration, prevention of oppression and mismanagement, compromise, arrangement. Company formation and incorporation, promoter, capital subscription, company and association, memorandum and articles, prospectus and statements, meetings and Company Act. Share and debentures, application, allotment, transfer and transmission, calls and forfeiture, dividend and interest, account and audit, taxes. • Official Correspondence: Difference between official letter and demi official letter. Formal and informal letters. Types and differences. Writing applications, drafting letters, complaint, notices. Preparation of agenda/minutes and reports, circular & memorandum etc. Commercial, officials, demi official, meaning, importance, objectives, sales letter, trade order agency correspondence, import, export trade, secretarial correspondence, application for jobs, post of accountant, lecturer, reminder. • Communication Skills and its introduction: Communication and its importance, Principles of effective communication, Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication - characteristics, components- Para- language, Body language. Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Listening Skills Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills. Facing interviews- Manners, etiquettes, dress code for an interview, Do's & don'ts for an interview, Behavioral Skills- Problem solving Confidence building Attitude. • GENERAL KNOWLEDGE: Energy Conservation, Global Warming, Relationship between society and environment, ecosystem and factors causing imbalance. Welfare Acts Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act, Accident & Safety- Accident prevention techniques-- control of accidents and safety measures.

Sl No	Course Title	Syllabus
5	**BASIC COMPUTER KNOWLEDGE**	• Concept and Importance of Computer in Communication. General Idea of various operating systems, Computer Fundamentals: Introduction, Definition, Utility, types and applications of Computers. Hardware: Definition & Introduction, Motherboard, Processor, Input & Output Devices and Storage devices. Software: Definition & types of Software, Introduction of MS- Excel: Opening a Worksheet; Entering text in worksheets, Editing Excel - selecting cells, editing cell contents; saving; printing. Internet.