DETAILED SYLABUS FOR THE POST OF JUNIOR GEOPHYSICIST IN GROUND WATER DEPARTMENT
CATEGORY NO.468/2024

Module	Detailed Module	Mark
Module 1	**Basic Ground Water Geophysics:** Hydrology cycle, origin and vertical distribution of ground water, Groundwater occurrence, classification of rock with respect to their water bearing characteristics: aquifer, aquiclude, aquitard, aquifuge and classification of aquifers; Multi-layer aquifers, Aquifer Characteristics and Aquifer parameter; Darcy's law and its validity, Hydro-geochemistry:characteristics of groundwater, classification of groundwater in respect to domestic, irrigation and industrial uses, Pollution of groundwater.	12
Module 2	**Solid Earth Geophysics:** 1. Shape and size of the earth, international gravity formula and rotation of the earth. Concept of isostasy - Airy, Heiskanan and Pratt- Hayford hypotheses. 2. Internal constitution of the earth, characteristics of lithosphere, and asthenosphere, causes of geodynamical process, continental drift. Ocean floor spreading, plate tectonics and plate boundaries, geomagnetic time scale, Benioff zones, oceanic ridges, triple junction, trenches and island arcs, hot spots. 3.Geomagnetism, geomagnetic storms, Earth's current, sun spot, solar flares, lunar and solar variations, Palaeomagnetism, polar wandering, reversal of geomagnetic field. 4.Heat flow, thermal history of the earth, sources of heat generation and temperature distribution inside the earth, Radiometric dating.	14
Module 3	**Electrical and Electromagnetic Prospecting:** 1.Electrical methods of geophysical prospecting, classification of electrical methods. Principles of Resistivity methods, Instruments for Resistivity methods; Resistivity meters, electrodes and field procedures. Resistivity array configurations (Wenner, Schlumberger, dipole-dipole, pole-pole, pole-dipole), Profiling and Sounding techniques- Horizontal resistivity profing (HRP) and Vertical Electrical Sounding (VES); Resistivity imaging, Resistivity Data curves. 2. Membrane and Electrode polarizations, IP field equipments, field procedure, IP in time domain and Frequency domain measurements, interpretation and applications. 3.Principles of EM prospecting. Classification of EM methods. Induction: Telluric method, Geomagnetic Depth Sounding. Magnetotelluric methods: Origin and characteristics of MT fields.	14

Module 4	**Seismic methods:** 1. Introduction to seismology, focus, focal depth, epicentre, intensity and magnitude scales and energy of earthquakes, foreshocks and aftershocks, Elastic rebound theory after Harry F Reid, seismicity of India, Himalayas and global seismicity, seismic zonation, seismic micro-zonation, seismic zoning of India, induced seismicity, concept of inhomogeneity and anisotropy, types and causes of earthquake. 2.Seismic ray theory for spherically stratified earth and velocity structure from travel time data, propagation and characteristics of body waves, surface waves, group and phase velocities, different phases of body waves and their applications, preparation of preliminary reports and identification of phases, determination of epicentre, focal depth and magnitudes, theory of elasticity, reflection of body waves, focal mechanism solutions and tectonic implications, earthquake generation models, hazard analysis, reflection of seismic waves from the free surfaces. 3.Principle of electromagnetic seismograph, displacement meters, velocity meter, accelerometer and strain meter seismographs, World-Wide Standardized Seismograph Network (WWSSN) stations, seismic arrays for detection of nuclear explosions, wide-band seismometry, strong motion seismograph.	14
Module 5	**Gravity and Magnetic Methods:** 1.Gravity prospecting instruments: borehole and airborne gravimeters, magnetic prospecting instruments, Rubidium vapour magnetometer. 2.Data Acquisition and Correction: Aeromagnetic surveys, corrections for gravity and magnetic data, calculation of derivatives, continuation methods, polynomial fitting for regional- residual separation of gravity and magnetic anomalies, graticules and anomalies of irregular bodies, relation between gravity and magnetic potentials, depth estimation, curve matching techniques.	14
Module 6	**Radiometric methods:** Half-Life, Decay Constant, Radioactive Equilibrium, Application of Radiometric Methods for Exploration, G M Counter, Radioactive Waste Disposal, Semiconductor Devices, Scintillation Detector	8
Module 7	**Well Logging Techniques:** 1.Objectives of well logging methods 2.Electric-Logging: Spontaneous Potential (SP) logging: Spontaneous potentials in boreholes and its sources 3.Radiation Logging: Gamma ray logging, gamma-gamma ray logging, neutron-gamma logging, neutron-epithermal- neutron logging. 4.Miscellaneous Logging Techniques: Acoustic velocity (Sonic) logging, Cement Bond Log (CBL), Litho-density Tool (LDT), Thermal log, caliper or section gauge log, Casing Collar Locator's (CCL), dip and direction logging, gravity logging, nuclear magnetic resonance logging.	12
Module 8	**Remote Sensing (RS) and GIS:** 1.Fundamentals of Remote Sensing: Energy sources, principles of solar and terrestrial radiation, laws of radiation, energy interactions, spectral patterns and signatures. 2.RS and GIS application in in various earth science studies and allied topics – structure and tectonics, Lithological mapping, mineral resources, natural hazards and disaster mitigation, groundwater	12

	potentials and environmental monitoring; LULC mapping, Application of RS and GIS in the potential area identification for water wells 3.Satellite navigation systems: Global Positioning System (GPS) and Global Navigation Satellite System (GNSS). Applications of GPS and GNSS in the field of ground water studies	
Total Marks		**100**

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper