

**DEPARTMENT OF GEOLOGY  
KURUKSHETRA UNIVERSITY, KURUKSHETRA**

Scheme for Entrance Examination for Ph.D. Course in Geology

Paper No.	Nomenclature of Paper	Max. Marks	Time Allowed
I	Objective type	100	1 hr.
II	Geology (Descriptive)	100	2 hrs.

**Paper – I** It will consist of objective type questions (number of questions: 50; questions to be attempted: 50) with major emphasis on research methodologies, aptitude of scientific and quantitative reasoning, elementary knowledge of computer science and general awareness of Geo-Sciences.

**Paper – II** It will consist descriptive type questions. Twenty five (25) questions will be set in all. Question no. 1 of 20 marks relating to research methodology is compulsory. From the remaining 24 questions of general nature of the subject carrying 10 marks each, the candidates are required to attempt any 8 questions

The medium of Examinations Shall be English.

Paper I & Paper II will be conducted in the same date.

To become eligible for Ph.D registration, the candidate must obtain at least 50% marks in each paper separately (45% for SC/ST).

## Syllabus for Paper I

### 1. COMMON ELEMENTARY KNOWLEDGE OF COMPUTERS

History of development of computers, mainframe, mini, micro and super Computer Systems, General awareness of Computer Hardware i.e. C.P.U. and other peripheral devices (input, output and auxiliary storage devices), Basic knowledge of computer systems software and programming language.

### 2. GEO-SCIENCES

**General:** - Geosciences, its division and relation to other sciences. Development of Geological thoughts through time. Exo- and endo- genetic processes. Sampling and procedures of laboratory and analyses of samples and representation of Data in various modes.

**Mineralogy:-** Crystal Chemistry, Mineral Classifications, Elementary physical, Chemical and optical properties of common rock forming minerals.

**Petrology:-** Forms, Structures, textures, mineral compositions and classifications of different types of rocks.

**Structural Geology:-** Primary and Secondary structure in rocks – their classifications, their recognition in the field and maps.

**Surveying:-**Basic concept of different types of surveys and their practical application in planning and management of resources and landscape.

**Paleontology:** - Types, nature and applications of paleobiology in geosciences, environmental and climatic reconstruction and interpretation through time.

**Stratigraphy:** - Stratigraphic classifications and distribution of rock sequences through time and their stratigraphic nomenclature with bearing on economic deposits.

**Economic Geology:** - Elementary Concept of different ore forming processes. Distribution and Geological Setting of Important Metallic and non – metallic mineral deposits of India including Coal, Petroleum and atomic minerals. Concept of ore, gangue, tenor and grade.

**Environmental Geosciences:** - Basic concept of environment and ecosystem in relation to geosciences. Natural resources, their development, conservation and planning. Mitigation of pollution and environmental hazards.

**Geoexploration:** - Basic concept of geological, geophysical, geochemical, remote sensing and paleobiological exploration techniques and their application in geosciences.

## SYLLABUS FOR PAPER II

### **MINERALOGY, INSTRUMENTATION, IGNEOUS & METAMORPHIC PETROLOGY, GEOCHEMISTRY & GEOEXPLORATION**

Concepts of crystallography. Minerals crystallizing in different crystal systems. Pleochroism, Extinction, optic sign and other optical properties of common rock forming minerals. Sample & Slide preparation and basic principles of CL, TL, AAS, ICP – MS, XRF, SEM and EMP analytical Techniques.

Nature and evolution of magma. Basaltic and granitic systems. Variation diagrams, Major rocks type of India viz. granite, pegmatite, rhyolite, syenite, basalt, alkaline and monomineralic rocks. PTX in metamorphism. Concept of contact and regional facies of metamorphism. Paired metamorphic belts & ocean floor metamorphism.

Geochemical classification of elements and their studies in various spheres viz. litho, bio, atmo, hydro.

Salient aspects of geoexploration, Principles & Methods of geochemical, geophysical & geobiological exploration and sampling

### **PHYSICS AND CHEMISTRY OF EARTH, STRUCTURAL GEOLOGY, TECTONICS & FIELD GEOLOGY; COMPUTING TECHNIQUES IN GEOLOGY**

Earth relation to Solar System, Internal Structure and composition of Earth. Earthquakes, Major Tectonic zones in India, Dating Techniques and Tectonic Evolution of Indian Subcontinent. Elementary ideas about isostasy, mountain building, continental drift, sea – floor spreading and plate tectonics.

Mechanical properties of rocks, stress and strain. Folds, Faults, Joints – their morphology and Significance. Use of clinometers and Brunton compass in the field measurements, principles of geological mapping.

Use of computers in Geology, software in office suite, graphics software – their optimum use. Application of Internet in augmenting geological information and resources.

## **SEDIMENTOLOGY AND GEOMORPHOLOGY, ENVIRONMENTAL GEOLOGY, HYDROGEOLOGY AND REMOTE SENSING**

Weathering and liberation of sediments, concept of size, size classification, porosity, permeability, primary and secondary sedimentary structures and their geological significance, classification of clastic rocks, maturity of sediments, provenance, paleocurrent analysis, significance of heavy minerals, Lithification and diagenesis, continental and marine sedimentary environments and facies, flysch and molasse deposits. Methods of study: X-Ray diffraction, sieving and staining technique and DTA analysis of sediments. Application of sedimentary petrology to science, technology and industries; Seismites, paleoseismological studies.

Concepts of Geomorphic cycle, evaluation of landforms, influence of structure and lithology on drainage. Application of geomorphology in science – Engineering including land use planning and strategic terrain evaluation.

Environment and its components; Ecosystems, their types and characteristics; interactions among atmosphere, hydrosphere, lithosphere, biosphere and man – role of micro-organism; Demographic growth – depletion and degradation of agricultural land, forest, soil, water mineral and energy resources. Ethics of conservation, sustainable development and balanced ecosystem; renewable energy resources. Environmental hazards and anthropogenic crises – their mitigation and control; waste disposal and recycling; global warming – causes and control, nuclear energy hazards.

Water – its genetic types and physico chemical properties; hydrologic, precipitation, run-off, infiltration, evapotranspiration, soil moisture and their measurement; Groundwater and its mode of occurrence, springs and their types, types of aquifers, hydrological properties of aquifer material and their determination in field and laboratory; Groundwater flow, Darcy's Law and its validity. Groundwater quality its comparison with surface and Ocean Water; quality criteria for domestic, industrial and agricultural use; Ground water provinces of India. Groundwater management, water shed development and rain water harvesting; artificial recharge

and recycling. Groundwater exploration – application of aerial and satellite remote – sensing; groundwater pollution – its monitoring and control.

Remote sensing platforms, types of aerial photographs, photo-elements, photo-mosaics, IRS series of satellites and their sensor characteristics; Interpretation of aerial photographs and satellite images for geological mapping, mitigation and management of natural hazards such as floods, earthquakes, landslides, tsunamis, impact assessment of mining and deforestation, and geotechnical studies for dams, reservoirs, tunnels, highways and rail roads.

## **ENGINEERING AND MINING GEOLOGY, ORE GEOLOGY AND MINERAL ECONOMICS**

Mechanical behavior of soil and rocks their failure, failure envelopes foundation; resistance to sliding and treatment, soil profile, classification and types. Atterberge limits, angle of friction. Cohesion Engineering Structures, Case Studies Land slides causes and preventive measures. Construction and building material. Engg. Geology in Planning, design and construction of projects including watershed management and river training and flood control. Effect of earthquakes on Engg. Projects.

Mining methods, types, ocean bottom mining Principles of sampling, reserve estimation methods. Geology and Mining. Mine development and mining operation, Mine support and mechanization, mine safety measures and mine legislation.

Mineral economics, National Mineral Policy, Strategic; critical and essential minerals, foreign policy in mineral trade, M.C.R., INCOTERMS changing mineral requirement, Project feasibility report of mineral and ores. Principles of management in mineral industries. Principles methods of ore dressing. Refractory abrasive, ceramic, glass, fertilizers and cement Industries, Precious and semi precious stone, fossil – fuels.

Classification of ore deposits, Study of Important ore forming process. Forms, texture and structures of ores. Distribution of geological setting of economically significant ore deposits of India, Concepts of fluids ore deposit and plate tectonics.

Processes of coalification and transformation of organic matter in the sediments. Chemical characterization of coals / petroleum origin and tectonic control of coal / petroleum deposits in earth history. Geologic Conditions of formation of hydrocarbon deposits in India researchers future prospects, global scenario and management. Oil Traps, reservoirs, Horizon, theory of migration concept of oil.

Study of important atomic minerals of India.

### **Palaeobiology, Micropaleontology, Stratigraphy, Palaeogeography and Palaeocology and Palaeo climates**

Succession of Life through ages, Time Planes of extinction of life through geological history, Mechanism of evolution, Significance of biota in palaeoecological and palaeogeographic reconstruction, biostatigraphic zonation : Techniques for preparation of microfossils and their applications in ecological interpretation and hydrocarbon prospecting and biochronology.

Evolution of paleoclimate, atmosphere and hydrosphere; Quaternary paleoclimates – application of oxygen isotope, event stratigraphy – Pleistocene glacial – deglacial cycles and Holocene warming, event stratigraphy and sequence stratigraphy.

Controls and development of stratigraphic records, litho- chrono- and bio-stratigraphy of various stratigraphic sequences of earth history in India and their bearing on the genesis and formation of mineral deposits and fossil fuels. Conditions governing the formation / generation of stratified / strata-bound deposits.

