

**SYLLABUS FOR THE SUBJECT OF GEOLOGY
PAPER - I**

Total Marks: 100

Physical Geology: Earth as a member of the solar system; its origin, age, composition and internal structure. Geomorphic processes

Structural Geology: Physical properties of rocks and rock behavior in different tectonic environments; deformation by fracturing and folding; interpretation of linear and planar elements.

Paleontology: Paleontological principles and techniques and their application to the evolution of life, the ecological structure of ancient biological communities, and the history of the earth.

Stratigraphy and Sedimentology: Principles of stratigraphy; Stratigraphic record and nomenclature, Geological time scale, Stratigraphy of Salt Range. Origin, transportation and deposition of sediments; biostratigraphic dating and correlation; Sedimentary processes and environments.

Mineralogy/ Petrology: Crystal chemistry; crystal growth and mineral genesis, physicochemical principles governing crystal structures. Mineralogical, chemical, textural, and structural properties of igneous, metamorphic and sedimentary rocks; their origin and relations to evolution of the Earth crust and mantle including rocks of both the continents and ocean basins.

Geochemistry: chemical processes involved in the development of the earth and distribution of the elements in the earth's crust, atmosphere and ocean. Physical chemistry of soils including soil mineralogy (formation, relative stability, ion exchange properties) and surface chemistry. Principles of thermodynamics. Application of thermochemistry to high and low temperature processes.

Paper II

Total Marks: 100

Earth Resources: Fossil fuels, Nuclear mineral resources, Renewable energy resources, hydropower and geothermal energy, Water cycle, Surface water, Ground water, construction materials including those for concrete and aggregate, sand gravels, cement making and building stones; Fundamentals of Matellogeny and plate tectonics with reference to Pakistan. Uranium and strategic metals.

Engineering Geology: Fundamentals of Engineering Geology. Soil and rock properties. Landslides classification for slopes in rock and soil, Excavation principles in rock and soil. Stability of slopes – analysis. Site investigation and instrumentation. Dam sites of Pakistan (elementary analysis).

Remote Sensing and GIS: Introduction to the filed of remote sensing. Earth satellite systems for remote sensing. Applications in geological mapping, mineral prospecting, structural geology, geohydrology, engineering geology and geomorphology. Principles of geographic information system (GIS) including an overview of data structure, data types, methods of data analysis and cartographic modeling.

Climate and Climate Change: Scientific bases of the climate change phenomenon, climates of the past and theories of climate change. Impacts of a changing climate in different regions of the world, and mitigation strategies. Earth as a planet, its origin and composition. Rock forming major minerals. Fundamental description and classification of igneous, sedimentary and metamorphic rocks. Processes of Geomorphology both internal and external. Peneplain concept. Valley formation and Drainage patterns. Glacial landforms. Fossils, fossilization, modes of fossil preservation, geological signification of fossils. Geological timescale. Principles of stratigraphy, stratigraphic code and nomenclature, stratigraphy of Salt Range. Study of major structures i.e. Folds, Faults, Joints, Cleavage and linear structure. Fundamental concepts of Engineering Geology and Geohydrology Introduction to the concept of Environmental Geology and Global Climate Change. Fossils Fuels, hydropower, Geothermal Energy, Nuclear minerals, Renewable energy.

RECOMMENDED BOOKS

1. Albarade, F., (2003), Geochemistry: An Introduction, Cambridge Press.
2. Barnes, J.W. and Lisle, R.J. (2004), Basic Geological Mapping, John Wiley & Sons.
3. Bell, F.G., (2004), Engineering Geology and Construction, Spon Press, N.Y.
4. Bender, F.K. and Raza H.A.(1995), Geology of Pakistan, Gebruder Borntraeger.
5. Best, M.G. (2003) Igneous and metamorphic Petrology, Blackwell Science
6. Davis, G.H. and Reynolds, S.J. (1996), Structural Geology of Rocks and Regions, John Wiley & Sons.

7. Demers, M.N. (2005) Fundamentals of Geographic Information System, John Wiley & Sons.
8. Dobrin, M.B. and Savit, Ch.H. (1988), Introduction to Geophysical Prospecting, McGraw Hill.
9. Emery, D. and Myers, K.J. (1996), Sequence Stratigraphy, Oxford, Blackwell.
10. Hudak, P.F. (2005), Principles of Hydrogeology, 3rd Ed. CRC Press
11. Kazmi, A.H. and Abbas, S.G. (2001), Metallogeny and Mineral Deposits of Pakistan, Orient Petroleum Inc.
12. Kazmi, A.H. and Jan, M.Q. (1997) Geology and Tectonics of Pakistan, Graphic Publishers.
13. Keary, P and Vine, F.J. (1996) Global Tectonics, Blackwell.
14. Montgomery, C.W., (2005) Environmental Geology, McGraw Hill.
15. North, F.K. (1985) Petroleum Geology, Allen & Unwin.
16. Plummer, (2005), Physical Geology, Mcgeay and Carlson.
17. Raup, D.M. and Stanley, S.M. (1985), Principles of Paleontology, W.H. Freeman & Co.
18. Sam Boggs (1987), Sedimentology and Stratigraphy.
19. Shah. S.I. (1977) Stratigraphy of Pakistan, Geological Survey of Pakistan.
20. Solomon, S., Qin, D., Manning, M., (2007) Climate Change 2007: The Physical Science Basics, Intergovernmental Panel on Climate change (IPCC).
21. Thomas M.L, and Ralph, W.K. (2003) Remote Sensing and Image Interpretation, John Wiley & Sons.
22. Willam H.B. (1990) Principles of Mineralogy, Oxford University Press.
23. Yeung, Lo.C.P. and Lal, A.K. (2003) Concepts and Techniques of Geographic Information System, Prentice Hall.