

GEOLOGY

Paper II

Time Allowed : Three Hours

Maximum Marks : 200

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions.

There are **ELEVEN** questions divided under **SIX** Sections.

Candidate has to attempt **SIX** questions in all.

The **ONLY** question in Section A is compulsory.

Out of the remaining **TEN** questions, the candidate has to attempt **FIVE** choosing **ONE** from each of the other Sections **B, C, D, E & F**.

The number of marks carried by a question / part is indicated against it.

Symbols, abbreviations and notations have their usual standard meanings.

Attempts of questions shall be counted in sequential order.

Unless struck off, attempt of a question shall be counted even if attempted partly.

Answers must be written in **ENGLISH** only.

Neat sketches are to be drawn to illustrate answers, wherever required.

Wherever required, graphs / tables are to be drawn on the answer-book itself.

Any page or portion of the page left blank in the answer-book must be clearly struck off.

SECTION 'A'
(Compulsory Section)

1. Write notes on each of the following : 5×10=50
- 1.(a) Large Ion Lithophile Element (LILE) and High Field Strength Element (HFSE)
 - 1.(b) Carbonaceous chondrite
 - 1.(c) Birefringence and optical retardation
 - 1.(d) Isomorphism in minerals with examples
 - 1.(e) Phase rule and its application in phase diagram
 - 1.(f) Bedding and Lamination
 - 1.(g) Source of sediments
 - 1.(h) Metasomatism
 - 1.(i) Ozone hole in stratosphere
 - 1.(j) Magnitude of earthquake

SECTION 'B'
(Mineralogy, Geochemistry and Isotope Geology)
(Attempt any ONE question)

- 2.(a) What are interference colours? Why anisotropic minerals exhibit interference colours between crossed polars? Explain with neat sketches. 10
- 2.(b) Discuss the structure, types, composition, physical and optical properties of mica group of minerals. 20
- 3.(a) Define Gibb's free energy (G). Derive an equation showing relationship of G with Temperature (T) and Pressure (P). 10
- 3.(b) Discuss briefly geochemical characteristics of Rare Earth Elements (REE). Why REE abundance in a rock is expressed in chondrite normalized diagram? What is Eu-anomaly? 10
- 3.(c) Derive the basic equation of radioactive dating. What is half-life ($t_{1/2}$)? 10

SECTION 'C'
(Igneous Petrology)
(Attempt any ONE question)

- 4.(a) Discuss the variation in composition of basaltic magma with variation of its mantle source composition and degree of partial melting. 10
- 4.(b) What is Bowen's reaction principle? State Bowen's reaction series and discuss its role in understanding magmatic differentiation. 10
- 4.(c) Is there any relationship between nature of magma and its tectonic setting? Discuss with suitable examples. 10
- 5.(a) Describe 'perthitic' and 'granophyric' texture with neat sketches. How do you explain origin of perthitic texture with the help of a suitable phase diagram? 10
- 5.(b) What are bases of IUGS classification of plutonic rocks and volcanic rocks? Describe with neat sketch IUGS classification of granitoid rocks. 10
- 5.(c) What are carbonatites and alkaline rocks? Why carbonatite is always found in association with alkaline rocks? 10

SECTION 'D'
(Metamorphic Petrology and Processes)
(Attempt any ONE question)

- 6.(a) What are Barrovian zones? What is the basis for sub-division of these zones? 10
- 6.(b) Explain the concept of 'Geothermobarometry' in metamorphic rocks. 10
- 6.(c) Discuss the regional metamorphism of ultramafic rocks in terms of mineral association and P-T conditions (up to 600°C). 10
- 7.(a) Describe the characteristics of eclogite facies metamorphism. Add a note on types-mineral assemblages of eclogite. 10
- 7.(b) Give a brief account on the mineral association and formation conditions of charnockites. Add a note on their occurrence in India. 10
- 7.(c) What are migmatites? Name the types of migmatites. Discuss the petrographic components of migmatites. 10

SECTION 'E'
(Sedimentology)
(Attempt any ONE question)

- 8.(a) Write names of different types of tectonic sedimentary basins. Draw a labelled diagram of sedimentary basins of India. Add note on tectonic evolution and sedimentation history of Gondwana basin of India. 20
- 8.(b) Describe briefly basic concept of the sequence stratigraphy. 10
- 9.(a) Describe chemical and biogenic sedimentary structures. Add a note on their origin and implications. 20
- 9.(b) Discuss the procedure of palaeocurrent analysis in sedimentary rocks. 10

SECTION 'F'
(Environmental Geology and Natural Hazards)
(Attempt any ONE question)

- 10.(a) Discuss the impact of mineral extraction and processing in terms of water pollution. Add note on mineral sustainability related to mining. 20
- 10.(b) Discuss the application of G.I.S. in land use pattern. 10
- 11.(a) Explain various aspects of air pollution and its impact on environment. 10
- 11.(b) Briefly discuss the methods of nuclear waste disposal. 10
- 11.(c) What are the common source of groundwater pollution and contamination ? 10