

**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** and **F**.*

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

*Unless otherwise mentioned, symbols, abbreviations and notations have their usual standard meanings.*

*Neat sketches are to be drawn to illustrate answers, wherever required. They shall be drawn in the space provided for answering the question itself.*

*Wherever required, graphs/tables are to be drawn on the Question-cum-Answer (QCA) Booklet itself.*

*Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.*

*Any page or portion of the page left blank in the Question-cum-Answer (QCA) Booklet must be clearly struck off.*

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

**(Compulsory Section)**

- Q1. Describe the following in brief with diagrams and suitable examples, wherever necessary : 5×10=50**
- (a) Draw stereogram for crystal class 2 (Sphenoidal class). 5
  - (b) Name the members of plagioclase feldspar series and their composition ranges. 5
  - (c) Rubidium-Strontium geochronology. 5
  - (d) Compatible and incompatible trace elements. 5
  - (e) Crystal settling in magma chamber. 5
  - (f) Distinguish between S-type and I-type granites. 5
  - (g) Pressure solution. 5
  - (h) Two-feldspar thermometer. 5
  - (i) Give mineralogical and phase transformation changes at upper mantle transition zone – 410 km discontinuity. 5
  - (j) Draw a neat diagram showing forces acting at mid-oceanic ridges. 5

## SECTION B

Attempt any **one** question.

- Q2.** (a) Explain the coordination principle and discuss various possible coordination numbers describing their geometry. 15
- (b) Discuss the structure and composition for mica group of minerals. 15
- Q3.** (a) Explain the procedure for determining optic sign for uniaxial minerals. 10
- (b) Discuss mineral group with the general formula  $XY_2O_4$ . Explain series of members due to substitution of associated cations. 10
- (c) Explain the terms 'Primitive' and 'Non-primitive' space lattice. Depict the relationship of Bravais lattice with crystal system, using appropriate figures. 10

## SECTION C

Attempt any **one** question.

- Q4.** (a) Describe Goldschmidt's rules for trace elements distribution. Discuss interpretation of Eu and Ba anomalies. 15
- (b) Discuss applications of oxygen isotopes in paleoclimatic studies. 15
- Q5.** (a) Describe the different varieties of meteorites and their possible sources. 10
- (b) Write the rules pertaining to the principles that govern the entry of trace elements into minerals. 10
- (c) Write down the equation for Rayleigh's fractionation law. A basaltic magma (originally containing 940 ppm Ni) suffers fractional crystallization of clinopyroxene crystal only. Find out the Ni concentration in the derived magma if the parent magma suffers 20% fractional crystallization. [Given :  $K_{dNi}^{Cpx} = 4$ ] 10

## SECTION D

Attempt any **one** question.

- Q6.** (a) Draw a neat labelled diagram of the Diopside-Anorthite system (1 atm. dry) and describe the course of crystallization from two initial melts [ $P_1 : \text{Di}_{80}\text{An}_{20}$  and  $P_2 : \text{Di}_{30}\text{An}_{70}$ ]. Deduce the degree(s) of freedom at the eutectic point of this system. Give the system's petrogenetic significance. 15
- (b) (i) Explain batch melting and dynamic melting of the mantle.  
(ii) Describe the assimilation phenomenon when a basaltic magma assimilates a shale country rock. 15
- Q7.** (a) Describe perthitic and myrmekitic textures. Explain their origin with the help of relevant phase diagrams. 10
- (b) Give the ideal sequence for an ophiolite suite. Give the petrogenetic account of the ophiolite suite of rocks. 10
- (c) Discuss the types of igneous rock textures. Comment on the significance of poikilitic, porphyritic and flow textures. 10

## SECTION E

Attempt any **one** question.

- Q8.** (a) What are paired metamorphic belts and metamorphic facies series ? Discuss the P-T conditions, tectonic setting, processes and mineral assemblages involved in such metamorphic belts. 15
- (b) On a simple P-T- $X_{CO_2}$  diagram, show the mineral phases and reactions that develop during regional metamorphism of an impure limestone. 15
- Q9.** (a) Discuss with the help of neat sketches how porphyroblast-inclusion relations can help in interpreting the temporal relationship between tectonics and metamorphism. 10
- (b) Why is a system containing corundum, quartz, sillimanite and andalusite termed 'degenerate' ? Draw the phase boundaries to show the degenerate reactions among these minerals. 10
- (c) Describe the characteristics of ultra-high pressure metamorphism and its tectonic conditions. 10

## SECTION F

Attempt any **one** question.

- Q10.** (a) Draw a neat labelled sketch, label it and describe the generalized morphology of an island arc system. 15
- (b) Compare and contrast between Apparent Polar Wander and True Polar Wander curves. 15
- Q11.** (a) Discuss causes for the magnetic reversals in the Earth's Magnetic Field. 10
- (b) Discuss the sequence of events for the generation of plumes in the Earth's D'' layer. 10
- (c) Discuss paleontological evidence for Continental Drift. 10