M. Sc. Applied Geology Examination, 2022

(2nd Year, 1st Semester)

Geochemical and Geophysical Exploration

Paper – CORE/TH/11

Time : Two hours | Full Marks : 40

(Use a separate Answer script for each Part)

PART – I (20 Marks)

Answer any four questions.

1. a) Define the term, *field* in geophysical perspective.
   b) Does the grad operation of a scalar field give rise to another scalar field? Explain the answer.
   c) Show the fundamental difference between the divergence and the curl of a vector field.
   1+2+2 = 5

2. a) Derive the wave equation and determine the phase velocity of compressional waves.
   b) Find the relation between the curl of a displacement field and shear wave propagation.
   3+2 = 5

3. a) Explain the difference in geometric attenuations between body waves and surface waves.
   b) Using sketches show the phase velocity and the group velocity of seismic waves.
   3+2 = 5

4. a) With the help of a sketch define the volume of an infinitesimal mass element in terms of a spherical coordinate system.
   b) Determine the free-air and the Bouger corrections at a point in a terrain with an elevation of h from the reference plane. Use all the other conventional parameter for this problem.
   3+2 = 5

5. Derive a general equation of gravity anomaly for a dipping, thin sheet, and find the gravity anomaly at a point for a horizontal sheet with a thickness of t located at a depth of h.
   5

6. a) Using schematic drawings explain the basic difference between split-spread and common-mid-point methods in reflection seismology.
   b) Describe the theoretical principle in resistivity measurement using the general four-electrode method.
   2+3 = 5

PART – II (20 Marks)

Answer any *4 (four)* questions (4×5)

Answer any four (04) questions from the following: **(4×5 = 20)**

1. What is 'grade of an ore'? How does the background value differ from the threshold value for an economic mineral deposit ? Mention the major types of sampling techniques generally done during geochemical exploration. (1+2+2)

2. What is 'SPC'? stands for rotary drill? How does it vary with heterogeneity of subsurface lithology, encountered during deep drilling processes? Mention the major parameters that affect the magnitude of 'Drillibility' for rotary drill. (1+2+2)

3. Why is injection of filtrate an essential practice during deep rotary drill? Which type of clay is generally used for this purpose? Mention major advantages of that clay mineral as mind filtrate over other types. (2+1+2)

4. Mention the primary geological & geomorphological prerequisites of the deposits that can be mined through open cast mining. What type of mining process may be deployed to excavate deep seated, thick, widely expanded low dipping coal seam, overlain by thick un-weathered basaltic rock layers? – Explain in brief. **(2+3)**

5. **Choose the correct option from the following:** **(5×1=5)**

I. The stages followed in the mining of mineral resources are:

- **a.** Prospecting-Exploration-Development-Exploitation
- **b.** Prospecting-Development-Exploration-Exploitation
- **c.** Exploration-Prospecting-Development-Exploitation.
- **d.** Prospecting-Development-Exploitation-Exploration

II. The process eluviation is restricted mostly in the soil layers:

- **a.** O, A & E
- **b.** A, E & B
- **c.** O, A & B
- **d.** O, A, E & B

III. Long wall mining method is generally employed for:

a. Iron-ore mining
b. Copper mining
c. For both of the above i.e (a) & (b)
d. Not for the above i.e. (a) & (b)

IV. Which of the following underground mining method is 'supported method'?

1. Shrinkage stoping
2. Cut and fill stoping
3. Sublevel stoping

a. 1 and 2
b. 1 and 3
c. 3

V. The purpose of drilling is:

1. Making holes for blasting
2. Sub-surface sample collection to estimate quality and quantity of ore
3. Development of mine for drainage, slope stability etc.

a. 1
b. 1 and 2
c. 2 and 3
d. 1, 2 and 3