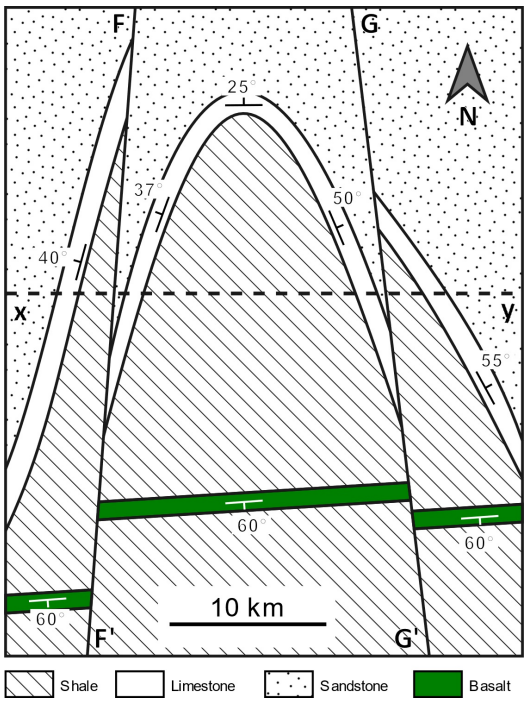
Part I

1. The given map pattern has been observed on a planar and horizontal topographic surface. FF′ & GG′ are traces of two fault planes.



(A) Draw a structural cross section along line xy. It is necessary to show the sense and relative amount of inclination of the strata in the cross-section diagram. It is, however, not necessary to draw diagram to the scale, or to show the apparent dip of the strata accurately. [10]

(B) Describe the structure of the limestone layer. [5]

(C) State with justification the nature of movement along the faults represented by FF′ & GG′. [5]

(D) State with justification which one is youngest and which one is oldest among Limestone, Basalt and the pair of faults. [5]

Part II: 5 questions 8 marks each

1. Why do shear fractures not form at 45° to σ_1, where the resolved shear stress is at its maximum?

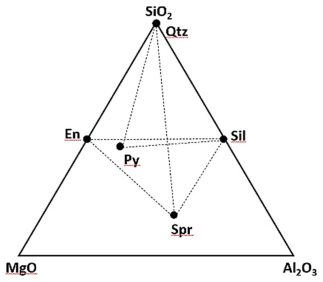
2. Define with a neat and labelled sketch the three components of a sandstone as observed under the petrographic microscope. Why sandstone is called a polygenetic rock?

3. Write a short note on how Tectonic processes affect the distribution of organisms.

4. How zone fossil is different from index fossil? Name one Early Triassic vertebrate index fossil. State the use of this fossil.

5. Using the chemographic projection below:

Qtz:	Quartz	(SiO_2)
En:	Enstatite	($MgSiO_3$)
Sil:	Sillimanite	(Al_2SiO_5)
Py:	Pyrope	($Mg_3Al_2Si_3O_{12}$)
Spr:	Sapphirine	$(Mg,Al)_8(Al,Si)_6O_{20}$



   (a) Define the system, and the number of univariant equilibria and invariant points in the system.

   (b) Deduce ALL the possible univariant equilibria (tie-line-flip and terminal reactions).

   (c) Using Schreinemakers analysis, constrain the 'topology' of the petrogenetic grid involving the deduced reactions.

Part III: 5 questions with 4 marks each. Justify your answer

1. Mohr Coulomb criterion does not fit for

   (A) Shear fracture

   (B) Tensile fracture

   (C) Stylolite

   (D) Fold

2. Which of the following statements is correct? Justify your answer with the help of schematic diagram.

   (A) All concurrent Range Zones are Assemblage zones.

   (B) Assemblage Zones are Taxon Range Zones.

   (C) Assemblage Zones are Acme Zones.

   (D) All Taxon Range Zones are Acme Zones.

3. The A/CNK ratio is used to distinguish between which two different bulk rock compositions? Justify your choice.

   (A) High-Al pelites and Low-Al pelites

   (B) Low-Al pelites and Charnockites

   (C) Charnockites and Granites

   (D) High-Al pelites and Granites

4. Neogene witnesses maximum biodiversity:

   (A) Longest coast line

   (B) Positions of continents

   (C) Warmer climate

   (D) All of the above

5. In some cases, vicariance can be related to plate tectonics as it is the phenomenon for

   (A) Species formation due to geographic isolation

   (B) Species formation due to high altitude habitat only

   (C) Species formation due to low altitude habitat only

   (D) Species formation due to marine habitat only

Part IV: 15 questions with 1 mark each

1. Positive $\delta^{18}O$ indicates:

   (A) Warm climate

   (B) Cold climate

   (C) Humid climate

   (D) None of the above

2. A carbonate sedimentary rock entirely made up of mineral Dolomite is called as:

   (A) Dolomite

   (B) Dolostone

   (C) Limestone

   (D) Both (A) and (B)

3. Shallow infaunal benthic foraminifera lives:

   (A) 0–1 cm depth in sediments

   (B) $1 - 2$ cm depth in sediments

   (C) $2 - 3$ cm depth in sediments

   (D) $3 - 15$ cm depth in sediments

4. According to Anderson's theory of faulting σ_2 axis is vertical for

   (A) Normal fault

   (B) Reverse fault

   (C) Strike slip fault

   (D) None of the above

5. San Andreas fault is a

   (A) Strike slip plate boundary

   (B) Collisional plate boundary

   (C) Mid-oceanic ridge

   (D) Triple junction

6. Both strength and plasticity of a rock increase with the

   (A) Increase in temperature.

   (B) Decrease in strain rate.

   (C) Increase in confining pressure.

   (D) Increasing strain rate.

7. Which of the following clay minerals is most commonly associated with most intense chemical weathering?

   (A) Chlorite

   (B) Montmorillonite

   (C) Kaolinite

   (D) Illite

8. The most primitive/pristine meteorite is

   (A) Achondrites

   (B) Ordinary chondrites

   (C) Carbonaceous chondrites

   (D) Stony-iron meteorites

9. Which one of the following sedimentary basins is related to extension?

   (A) Foredeep

   (B) Half-graben

   (C) Piggyback

   (D) Fore-arc

10. Which of the followings form continuous solid solution series?

    (A) Calcite-dolomite

    (B) Dolomite-magnesite

    (C) Magnesite-siderite

    (D) Siderite-calcite

11. Sphalerite is an ore of

    (A) Copper

    (B) Zinc

    (C) Manganese

    (D) Lead

12. Find the odd man out.

    (A) Calcite

    (B) Aragonite

    (C) Barite

    (D) Siderite

13. Imbricated discoid clasts in a riverbed represent:

    (A) Saltating population

    (B) Suspended population

    (C) Rolling population

    (D) Sliding population

14. Which of the following features in an ancient fluvial succession can help you to distinguish a meandering river deposit from those produced by other river types?

    (A) Predominance of trough cross-bedded sandstones

    (B) Predominance of sandstones showing large-scale soft-sedimentary deformation structures

    (C) Presence of mudstones containing mature paleosols

    (D) Presence of rip-up mud clasts in the sandstones

15. A buffer operation in a GIS can create:

    (A) Lines from polygon features

    (B) Points from line features

    (C) Polygons from polygon features

    (D) Points from polygon features