



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Mineralogy and Petrology

Subject: Geochemistry

Paper: GEOL-437 G1

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q.1. Explain role of partial melting, fractional crystallization and magma mixing in igneous rocks.
- Q.2. Discuss the origin of elements and their abundance in nature.
- Q.3. Elaborate the process of metasomatism.
- Q.4. Differentiate various types of magma series and their geological characteristics.
- Q.5. What are the discrimination diagrams? Discuss their significance.
- Q.6. How feldspar can be used as geothermometer.
- Q-7. Write a note on geochemical classification of elements.



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Mineralogy and Petrology

Subject: Igneous Petrology

Paper: GEOL-438 G1

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All questions carry equal marks. Be brief and to the point and draw the sketch where needed.

- Q. 1. Discuss the common characteristics and spatiotemporal distribution of the Komatiitic and Tholeiitic rock suites.
- Q. 2. Discuss the utilization of major and trace element variation diagrams and normalization plots in petrogenetic studies of igneous rocks.
- Q. 3. Discuss the types of igneous rocks based upon the silica and alumina saturation and their petrogenesis.
- Q. 4. Compare and contrast the Continental Flood Basalts and Mid Oceanic Ridge Basalts.
- Q. 5. Discuss the following:
- a. Large Igneous Provinces
 - b. Primary Magma
 - c. Peacock Index or Alkali-Lime Index
 - d. Decompressional partial melting
 - e. Pegmatites



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Specialization: Mineralogy and Petrology

Subject: Sedimentary Petrology

Paper: GEOL-440 G1

Roll No.

Time: 3 Hrs. Marks: 75

**NOTE: Attempt any THREE Questions. All Questions carry equal marks.
Support your answers with help of figures and diagrams.**

- 1- How conglomeritic rocks are classified? Describe with trinary diagram.
- 2- Describe the dissolution cementation, primary and secondary porosity in sandstone.
- 3-- Discuss the diagenesis of sandstones in details, describe with figures.
- 4- What are the mud rocks and how they are classified based on their composition.
- 5- What types of porosity are resent in sandstones, describe each with details.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Mineralogy and Petrology
Subject: Advanced Mineralogy

Paper: GEOL-441 G1

Time: 3 Hrs. Marks: 75

Note: Attempt any THREE questions. All questions carry equal marks.

Q.1- Attempt any Six Short Questions from the following;

6×5=30

- I. Why same minerals may have different crystal sizes.
- II. Differentiate calcite and dolomite.
- III. Draw any triangular plot and label it.
- IV. What are the types of mineral luster?
- V. State four forms of tenacity.
- VI. What is the difference between fluorescence and phosphorescence?
- VII. Phyllosilicates are also called sheet silicates. Write other names of disilicate, ring silicate, island / orthosilicate, chain silicate, and framework silicate.
- VIII. Beryl belongs to which mineral group? Pakistan is famous for two gem varieties of beryl. Name them.

Attempt any THREE QUESTIONS from the following;

3×15=45

- Q.2. Describe Oxide group of minerals.
- Q.3. Write a note metallic mineral potential of Pakistan.
- Q.4. Write a note on Plagioclase Feldspar.
- Q.5. Write the properties, structure, occurrence, and uses of sulfide minerals.
- Q.6. Write a note on mineral nucleation, mechanism of crystal growth, and importance of reaction kinetics in mineral formation.



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Engineering Geology

Subject: Rock Mechanics

Paper: GEOL-437 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. All questions carry equal marks.

Q.1	What are physical properties, discuss any five properties in detail with their influence on mechanical response of the rocks.	25
Q.2	Discuss comprehensively with illustrations the response of the intact rock in various loading conditions (compression and Tension).	25
Q.3	What is role of discontinuities in controlling the mechanical response of rock masses, write a brief yet comprehensive note on any four discontinuity parameters.	25
Q.4	How logging is undertaken in cored holes, discuss the important parameters to be recorded and mentioned on the logs.	25
Q.5	Discuss with illustrations the conditions favorable for following modes of rock slope failure. <ul style="list-style-type: none">• Plane Failure.• Toppling	25



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Engineering Geology
Subject: Soil Mechanics

Paper: GEOL-438 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All questions carry equal marks.

- Q.1 Discuss Mohr-Coulomb theory and failure envelopes for sand and clay.
- Q.2 How has soil mechanics development contributed to foundations, underground and earth retaining structures, pavement design, excavations, embankments, and dams?
- Q.3 Write a note on stress distribution in soil.
- Q.4 Discuss the following terms.
i. Well graded and poorly graded soil.
ii. Modes, mixtures and gap grading in soil particle size.
iii. Utilization of soil particle size distribution test.
- Q.5 Write a short note on following
i. State the soil physical properties based for Unified classification system.
ii. Which laboratory tests are required for Unified classification system?
iii. Symbols used in Unified classification system.
iv. On which bases the subdividing coarse grained and fine grained soil in Unified classification system?
- Q.6 Write a note on the bearing capacity and shear strength of the soil.
- Q.7 Explain the following terms.
i. Water content
ii. Bulk unit weight
iii. Unit weight of solids
iv. Dry unit weight
v. Specific gravity of solids
- Q.8 Explain the mechanical analysis of soil using particle size accumulation curve method.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Engineering Geology
Subject: Seismotectonics

Paper: GEOL-439 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

Q.1 What is significance of subsurface discontinuities in seismicity on the earth? Discuss in detail. (15)

Q.2 How seismotectonic maps are produced? Give components involved. (8+7=15)

Q.3 Define Deterministic seismic hazard analysis (DSHA), how it model is applied for seismic risk assessment (5+10=15)

Q.4 What is the regional impact of convergent boundaries? Elaborate in prospect of tectonics of southern Pakistan. (5+10=15)

Q.5 Define seismic hazard curves, how these are generated for a seismic event. (5+10=15)

Q.6 Discuss the phenomena of densification of landslide material. (15)

Q.7 How geophysical prospecting is handy in determination of a suitable groundwater bodies? Describe its applications for groundwater management. (15)

Q.8 Write a note on the following. (8+7=15)

- a) Probabilistic Seismic Hazard Analysis (PSHA)
- b) Electrical Resistivity Tomography (ERT)



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Engineering Geology
Subject: Engineering Geology

Paper: GEOL-440 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All questions carry equal marks.

1. Write a comprehensive note on the various assignments/phases of Engineering Geological studies pertaining to planning and designing of any civil engineering project.
2. Define effective stress in subsurface and explain how groundwater effects the strength of the rocks. Draw and describe the effects of pore water pressure on Mohr Coulomb failure circle. Draw the stress strain graphs for typical rock under pressure and label their deformation features under the conditions of (1) dry confined, (2) dry unconfined and (3) increased pore water pressure.
3. Write a note on rock forming mineral with detail of their chemical subdivision, mineral name, color, physical features and engineering properties.
4. What are the general assumptions in analytical methods of slope stability analysis? Derive the stability relation of an infinite slope along with special cases of (a) dry cohesionless soil, (b) saturated cohesionless soil (c) sandy clayey soil.
5. Describe in detail the various geological considerations in Tunneling.
6. (a) what are the implications if resultant load to be transferred to the foundation underneath a gravity dam be directed perpendicular and parallel planes of weakness?
(b) describe the key notes that needed to be consider for planning of geotechnical investigation program for a bridge.
(c) How could a rockfall hazard scenario along a road cut slope be mitigated?
7. Write a comprehensive note on the geological considerations in dam construction.
8. What is rock weathering? Discuss the various modes of rock weathering and their corresponding host materials. describe implications of weathering on limestone.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Petroleum Geology

Subject: Petroleum Geology

Paper: GEOL-437 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. All questions carry equal marks.

- Q. 1 What is porosity? Discuss different types and factors effecting porosity.
- Q. 2. What is migration? Explain types of migrations and effect of different factors.
- Q. 3. How to acquire petroleum lease area? Explain in detail.
- Q. 4. What is difference between petroleum system and petroleum play?
- Q. 5. What are fractures? Describe different types of fractures and their importance in petroleum industry.



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Petroleum Geology

Subject: Sequence Stratigraphy

Paper: GEOL-438 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt FOUR Questions in all while Questions No. 1 is Compulsory.

Q1 Write short note on any five of the following. (3+3+3+3+3)

1. Sequence Boundary (SB-1)
2. Resistivity Log.
3. Accommodation space.
4. long-term and short-term stratigraphic cycles.
5. Sediments supply.
6. Lithostratigraphy.
7. Chronostratigraphy.
8. Internal Reflection Patterns

Q2. Discuss in detail the concept of facies, facies association, cyclicity and architectural elements with examples and diagrams? (20)

Q3. (a) Define sequence and development sequence? (08)

(b) Write note on

i) Aggradation. ii) Progradation. iii) Retrogradation.? (12)

Q4. Describe and discuss application of sequence stratigraphic based on wireline log data framework?

Q5. Define and explain the term system tracts? Discuss the development of various Components of Type-I sequence? (20)

Q6. What are the Parasequences? Discuss development, formation and thickness? of Parasequences? Describe Parasequence sets and various types of Parasequence sets (20)



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Petroleum Geology

Subject: Petroleum Engineering & Geophysical Methods Paper: GEOL-439 G5 Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

Q1. Explain the Huygens principle and concept of Fresnel zone used to delineate the subsurface layers.

Q2. Describe the Reflection and transmission coefficient. Make a neat and clear diagram to explain the concepts.

Q3. Explain the spherical divergence, quality factor and specific dissipation function. Also, describe the relationship among them by providing equation.

Q4. Explain the Common-midpoint (CMP) gathers and Normal Moveout (NMO) correction in detail. Draw a neat and clear diagram to explain the concept.

Q5. Describe the rotary system of the rotatory drill. Make a neat and clear diagram to explain the concepts.

Q6. What is meant by well logging? Describe different types of logs used to describe rocks and fluids.

Q7. Explain the borehole environment in detail. Draw a neat and clear diagram to explain the concept.



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Petroleum Geology

Subject: Reservoir Geology

Paper: GEOL-440 G5

Time: 3 Hrs. Marks: 75

**NOTE: Attempt any THREE Questions. All questions carry equal marks.
Support your answer with help of figures and diagrams.**

1. A reservoir with CaCO_3 as cementing agent has high porosity and permeability than a reservoir with SiO_2 as a cementing agent? Discuss the scenario with reference to depositional environment.
2. Enlist the merits and demerits of high porosity in unconventional shale source/reservoirs.
3. How rock fabric plays its role to estimate quantity of hydrocarbons in carbonate/ clastic reservoirs.
4. "Reservoir rocks should be in direct contact with source rock". Is it true or false. Support your statement with facts and figures.
5. Sandstone is a good reservoir, discuss the factors that destroy its capacity to hold hydrocarbon.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Applied Geophysics

Subject: Seismic Method and Seismic Stratigraphy

Paper: GEOL-437 G6

Time: 3 Hrs. Marks: 75

NOTE: Question number ONE is compulsory.
Attempt any THREE questions from the remaining.

1 (a) Define any six of the following terms

(6x2=12)

Raleigh wave, Dynamic range, Fresnel Zone, Dominant frequency, Critical angle, Sequence boundary, DHI, Maximum flooding surface, Wave dispersion, Bulk modulus

(b) Give the short answers of any six questions.

(6x2=12)

- Differentiate between visualization and resolution.
- Differentiate between band width and effective band width.
- Differentiate between single and noise in seismic data.
- Differentiate between array and wave.
- Differentiate between sequence stratigraphy and seismic stratigraphy?
- Describe the tuning thickness.
- Why the zero phase wavelet is more desirable for seismic interpretation?
- What information is stored when a seismic trace is saved in a SEG Y format?
- What is forward seismic modeling?

2 (a) Why seismic data acquisition is important in petroleum prospecting? Being a field geophysicist describe your role in seismic data acquisition.

8

(b) In a desert area a 2D seismic data acquisition is planned with 3,000 m target depth. The group interval is 50 m, minimum offset is 25 m and far offset receiver is at 5,975 m. What will be total number of channel used? The wavelength of ground rolls is 5 m in this area what will be the minimum spacing between the geophones to override the ground rolls?

9

3 (a) Describe in detail the Fresnel zone and its importance to seismic imaging

9

(b) What is synthetic seismogram? How it is prepared? Why synthetic seismogram is important in seismic data interpretation?

8

4 (a) What are convolution and deconvolution and why these are used? Briefly describe and compare different types of deconvolution.

9

(b) What is correlation? Discuss its different types with some numerical example.

8

5 (a) What is seismic data interpretation. Discuss in detail different types of seismic data interpretation.

9

(b) Consider two geological layers. In the top layer, the P wave velocity is 4000 m/s, S wave velocity is 2150 m/s, rock porosity is 20 % and density is 2.35 gm/cc. what will be the value of shear and bulk modulus in that layer?

8

6 (a) Write a note on the factors controlled the seismic resolution both horizontal and vertical.

8

(b) A sinusoidal signal has only two frequency components 100 and 150 Hz. You digitized the signal using a sampling interval of 4 ms? (a) Would aliasing occur to the 100 Hz frequency component? If yes, calculate the aliasing frequency? (b) Would aliasing occur to the 150 Hz frequency component? If yes, calculate the aliasing frequency?

9



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Geophysics

Subject: Earthquake Seismology

Paper: GEOL-438 G6

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All questions carry equal marks.

- Q1. Explain the elastic rebound theory used to describe earthquakes occurred due to the lithospheric late movement.
- Q2. Define the earthquake intensity and its scales. Explain salient features of Rossi Forel and MSK intensity scales.
- Q3. Estimate the intensity class and probable Richter magnitude (ML) range of an earthquake event that produced ground shaking at an acceleration of 2.5 ms^{-2} which lasts for a period of 15 s.
- Q4. Explain different types of guided waves and their respective signatures on seismogram. Also, describe the advantages of each type of the waves.
- Q5. Describe different effects of large earthquakes on the water. Also, define the tsunamis and their mode of generation
- Q6. Explain the following in detail: (a) Volumetric elasticity, (b) Shear modulus, and (c) Poisson' ratio.
- Q7. Explain Earth's interior using Compressional and Shear wave velocities and density profiles as a function of depth. Draw the diagram and label it to describe the variation of each physical quantity.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Geophysics

Subject: Electrical Methods and Bore-Hole Geophysics

Paper: GEOL-441 G6

Time: 3 Hrs. Marks: 75

NOTE: Attempt FIVE questions while Question No. 1 is compulsory.
All questions carry equal marks.

Q 1; Give the short answers of the following questions.

- i) Why density log derived porosity overestimates in gas bearing reservoirs?
- ii) Write down the Schmoker's formula of TOC estimation?
- iii) Differentiate between profiling and sounding surveying procedures?
- iv) Write down the name of different factors on which the maximum depth of detection depends upon.
- v) What is the difference between focused and non-focused electrical currents?

Q 2; Explain the different types of apparent resistivity curves for sounding over one, two and three layered media.

Q 3; Explain the basic working principle and applications of electrical resistivity and electromagnetic methods in subsurface exploration.

Q 4; Explain systematic scheme of Rock Physics modeling to identify the hydrocarbon content in reservoir

Q 5; Define and elaborate Gamma ray log, discuss its qualitative and quantitative applications.

Q 6; Discuss different resistivity logging tools in detail, explain how it helps to distinguish between virgin and flushed zones?

Q 7; Explain the mechanism of Amplitude verses offset technique (AVO), elaborate different classes of AVO in detail.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Applied Geophysics
Subject: Gravity and Magnetic Methods

Paper: GEOL-443 G6

Time: 3 Hrs. Marks: 75

NOTE: Question No. 6 is compulsory. Attempt any THREE Questions from the remaining.

- Q-1: Derive formulae of gravity Anomaly caused by a sphere and for estimation of its depth and mass. 17
- Q-2: a). Give details of magnetic field reversal, how does it occur. 9
b). Discuss in details North West ward drift of magnetic poles. 8
- Q-3: Discuss the factors that affect the magnetic field data and how the data is corrected? 17
- Q-4: How the shape of earth and its rotation effect on the observed gravity data? Derive an equation for its correction. 17
- Q-5: a). Discuss in detail the causes of instrumental drift with time in gravity meter? 9
b). How do we calculate and apply drift correction in gravity field data? 8
- Q-6: Write short notes on any Four of the following. (4X6=24)
- a). How the shape and size of Gravity Profile is effected by density of ore body?
 - b). Magnetosphere
 - c). Topographic correction in gravity method
 - d). Bases of Gravity Method
 - e). Magnetic Storm



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Sedimentology
Subject: Clastic Sedimentology

Paper: GEOL-437 G8

Time: 3 Hrs. Marks: 75

**NOTE: Attempt any FIVE Questions. Explain with figures where necessary.
All Questions carry equal marks.**

- Q-1)** Write a note on clastic transport and fluid flow.
- Q-2)** Differentiate between primary and secondary sedimentary structures.
- Q-3)** Describe the composition, texture, and classification of conglomerates.
- Q-4)** Discuss the texture, depositional setting, and classification of mudrocks.
- Q-5)** Discuss the clastic shelf deposits and their diagnostic features.
- Q-6)** Explain the deltas and their diagnostic features.
- Q-7)** Differentiate between Braided Fluvial System and Meandering Fluvial System.
- Q-8)** Write notes on the following:
- | | | |
|----|----------------------|-----|
| a) | Lacustrine Deposits. | (8) |
| b) | Eolian Deposits. | (7) |



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Sedimentology
Subject: Carbonate Sedimentology

Paper: GEOL-438 G8

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

- Q.1. Explain the formation of Stromatolites? What are their different types? What environments are required for their formation?
- Q.2. Describe the Carbonate Facies model and the standard microfacies associated with the different types of environments?
- Q.3. Describe in detail the essential components of limestones? Give their comprehensive modern classifications?
- Q.4. What are Dolomites? How they are formed? Explain the different models of dolomite formations along with suitable diagrams?
- Q.5. What are Porosity and Permeability? Explain in detail the different types of porosity along with suitable diagrams?
- Q.6. What are the specific environments and physical parameters for deposition of carbonate rocks? Explain the deposition of carbonates in Bahamas and Persian Gulf?
- Q.7. Write notes on the following:
- a. Reefs, their types and economic significance (10)
 - b. Different types of carbonate minerals (5)



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2022

Roll No.

Specialization: Sedimentology
Subject: Sedimentary Petrology

Paper: GEOL-439 G8

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

1. Describe clastic Sedimentary Rock and describe the Mc Bride's classification of Sandstones.
2. Discuss the Sedimentary Texture of Siliciclastic Sedimentary Rocks.
3. Describe the classification of Conglomerates.
4. Discuss the Carbonate grains.
5. Write notes on
 - a. Flute casts
 - b. Ripple marks
 - c. Graded bedding
6. Describe diagenesis, discuss the major diagenetic environments and cement types formed in these environments.
7. Discuss the evaporate deposits.
8. Describe the following
 - a. Authigenesis
 - b. Replacement
 - c. Recrystallization



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2022

Specialization: Sedimentology

Subject: Basin Analysis

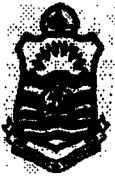
Paper: GEOL-440 G8

Roll No.

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All Questions carry equal marks.

1. a) Describe classification schemes of sedimentary basins. (20)
b) What are the mechanisms of crustal subsidence? (05)
2. Give schematic illustration of basins in the rift-drift suite as a function of increasing amounts of continental stretching. Also, explain the difference between rift basins and basins experiencing regional subsidence. (25)
3. What are the factors that control rate of sedimentation in any basin? Explain how accommodation space plays a role in basin formation and sedimentation. (25)
4. Write a detailed note on Lower Indus basin? Discuss its depositional systems, briefly. (25)
5. Explain the followings:
 - i) Depositional sequences (05)
 - ii) Stacking patterns (05)
 - iii) Foreland basins and orogenic belt (7½)
 - iv) Aullacogens and impactogens (7½)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018

Examination:- B.S. Applied Geology

Roll No.

Specialization: Mineralogy and Petrology

Subject: Geochemistry

PAPER: GEOL-437 G1

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All carry equal marks.

- Q.1. Discuss classification of elements in detail.
- Q.2. Explain geochemical classification diagrams
- Q.3. Describe geochemistry of intrusive rocks.
- Q.4. How geochemical characteristics of igneous rocks are used as petrogenetic indicators?
- Q.5. Discuss various factors which cause diversification of igneous rocks.
- Q.6. Discuss geochemical characteristics of various magma series.
- Q. 7 What is geothermometry? Discuss its role in the Petrogenesis of rocks.



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Paleontology and Stratigraphy
Subject: Advanced Stratigraphy
PAPER: GEOL-437 G2

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Note: Attempt any FIVE questions. All questions carry equal marks.

- Q-1: What do you know about
i, Law of Super Position
ii, Present is the key to the past 7,8
- Q-2: Discuss the Cambrian sequence of Hazara in detail. 15
- Q-3: Describe the environments of deposition of Tobra Formation. 15
- Q-4: What do you know about Cambrian-Permian Boundary in Salt Range. Explain with the help of a stratigraphic column. 15
- Q-5: Describe the K-T Boundary in Pakistan. 15
- Q-6: Describe the facies of Warchha Sandstone and its economic importance. 15
- Q-7: Compare the Paleocene-Eocene succession of Salt Range with Hazara and Kohat. 15
- Q-8: Write short notes on 5,5,5
i, Salt Range Formation
ii, Types of Unconformity
iii, Patala Formation



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Engineering Geology

Subject: Rock Mechanics

PAPER: GEOL-437 G4

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any THREE questions. All questions carry equal marks.

Question No.	Questions	Marks
Q.1	Discuss in detail the following characteristics of rocks; <ul style="list-style-type: none">• Density• Porosity• Permeability• Thermal Conductivity• Saturation	25
Q.2	What is a strength criteria of rocks, discuss Mohr-Coulomb Criteria for rocks.	25
Q.3	Define and explain the importance of following parameters of discontinuities in rock characterization; <ul style="list-style-type: none">• Orientation• Infilling• Persistence• Spacing• Roughness	25
Q.4	Write down the necessary conditions of the followings with illustrations; <ul style="list-style-type: none">• Sliding and Toppling• Wedge Failure	25
Q.5	How elastic parameters of the rocks are determined in Laboratory? Elaborate.	25



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018

Examination:- B.S. Applied Geology

Roll No.

Specialization: Petroleum Geology

Subject: Petroleum Geology

PAPER: GEOL-437 G5

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

Q.1 . Briefly explain any six questions from the followings;

6×5=30

- I. What conditions must be fulfilled for a commercial oil accumulation to occur?
- II. Write down four postulates of petroleum migration theory
- III. Explain the petroleum from Noah to organization of petroleum exploring countries.
- IV. Explain the composition and occurrence of Gas Hydrates.
- V. What geological and chemical facts must be explained by a theory of petroleum genesis?
- VI. Define and explain the porosity and capillary pressure.
- VII. Write down the three major phases in the evolution of organic matter.
- VIII. Seal and cap rocks.
- IX. Hydrodynamic Trap

Attempt any THREE questions from following;

15 ×3= 45

Q.2 Write an essay on stratigraphic Trap.

Q.3 Summarize the relationship of porosity, permeability and texture.

Q.4 Write a detail note on Crude oil and its chemistry along with its classification.

Q.5 How the formation of Kerogen occurs also tells about its chemistry and maturation.

Q.6 What are the different oil and gas production methods?

II) Explain the petroleum system in your own words



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018

Examination:- B.S. Applied Geology

Roll No.

Specialization: Geophysics

Subject: Seismic Method and Seismic Stratigraphy

PAPER: GEOL-437 G6

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Questions number ONE is compulsory. Attempt any THREE questions from the remaining.

- 1(a) Define any six of the following terms. (2x6)
Fermat's Principle, Reflection coefficient, critical distance, Dispersive waves, Transgressive surface, Pre-critical region, Gardner's Law, Tube wave, Horizontal resolution, SH wave.
- 1(b) Give the short answer of any six questions. (2x6)
- What is Bandwidth?
 - What are limitation of seismic refraction?
 - What is static correction?
 - What are surface multiples?
 - Define seismic facies.
 - How layers' velocities are determined from seismic refraction survey?
 - What is meant by impulse response?
 - Define Fold taper.
 - Write two factors that may produce mis-tie?
 - What is velocity pull-down? How it is produced? How it can be removed?
- 2(a) What is seismic resolution. What are the effects of different parameters on seismic resolution. How it can affect the seismic interpretation? (9)
- 2(b) What are seismic sources? Which characters of seismic sources are required? Write different types of seismic sources. (8)
- 3(a) What are different types of P-wave seismic velocities? Write their relation and utilities in seismic processing and interpretation. (9)
- 3(b) What is seismic to well tie? Which factors/parameters must be considered for seismic to well tie? (8)
- 4(a) Explain in detail the different factors that affect the seismic velocity? (9)
- 4(b) What is check shot survey and sonic logging? Compare their pros and cons. (8)
- 5(a) Write the seismic facies and their geological interpretation. (8)
- 5(b) Deduce the mathematical relationship between refractor depth and cross over distance for planner horizontal and planner dipping interface. (9)
- 6(a) Deduce the travel time equation for the refracted wave for the planner horizontal interface? (9)
- 6(b) Which processing step(s) can increase the bandwidth of the seismic data? (8)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

.....
Roll No.
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Specialization: Mineralogy and Petrology

Subject: Igneous Petrology

PAPER: GEOL-438 G1

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any THREE questions. All questions carry equal marks. Be brief and to the point and draw the sketch where needed.

- Q. 1. Differentiate between “enriched” and “depleted” Mantle. Which suite of volcanic rocks occurs in Hawaiian island?
- Q. 2. Briefly discuss the following:
- Mantle Plumes
 - Fractional Crystallization
 - Alumina Saturation Index
 - Mid Oceanic Ridge Basalts
 - Komatite Rock Suite
- Q. 3. Discuss the classification of igneous into rock suites also elaborate the chemistry, fractionation and tectonic setting of various rock suites.
- Q. 4. Discuss the Alphabetical classification of the Granitoids and its importance in understanding the petrogenesis of Granitoid rocks.
5. Discuss the IUGS Classification of Gabbroic Rocks



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018

Examination:- B.S. Applied Geology

Roll No.

Specialization: Paleontology and Stratigraphy

Subject: Micropaleontology

PAPER: GEOL-438 G2

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q-1: a, Describe the marine environments in detail. 7,8
b, Describe the different types of apertures in foraminifera.
- Q-2: Describe the two Guide/Index Fossils of Upper Cretaceous other than *Globotruncana* in detail. 15
- Q-3: Differentiate between *Globotruncana fornicate* and *Globotruncana carinata*. 15
- Q-4: Differentiate between the followings 5,5,5
i, *Dentalina* and *Nodosaria*
ii, *Lenticulina* and *cibicides*
iii, *Bolivina* and *Spiropletamina*
- Q-5: Describe the salient features of genus "*Assilina*" and give its types. 15
- Q-6: Explain the difference between *Nummulites mamillates* and *Nummulites atacicus*. 15
- Q-7: Describe the Genus "*Alveolina*" and its stratigraphic significance. 15
- Q-8: Write short notes on the followings: 5,5,5
i, *Ranikothalia*
ii, *Lenticulina*
iii, *Textularia*



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

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Roll No.
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Specialization: Petroleum Geology
Subject: Sequence Stratigraphy
PAPER: GEOL-438 G5

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Attempt any four questions. First question is compulsory.

- Q1 write short note on any five of the following. (3+3+3+3+3)**
- 1) Sequence Boundary (SB-1)
 - 2) Resistivity Log.
 - 3) Shelf Break System
 - 4) Maximum Flooding Surface
 - 5) High Stand Systems Tracts
 - 6) Lithostratigraphy
 - 7) Chronostratigraphy
 - 8) Internal Reflection Patterns
- Q2.(a) What are the sequence stratigraphic cycles? Discuss long-term and short-term stratigraphic cycles? (10)**
- (b) Describe and explain terms: (10)**
- i) Accommodation space ii) Sediments supply
- Q3.(a) Define sequence and discuss sequence models and approaches? (08)**
- (c) Write note on (12)**
- i) Aggradation ii) Progradation ii) Retrogradation?
- Q4. Describe and discuss application of sequence stratigraphic based on wireline log data framework? (20)**
- Q5. Define and explain the term system tracts? Discuss the development of various types of system tracts both along shelf break and ramp margin ? (20)**
- Q6. What are the Parasequences ? Discuss development, formation and thickness? of Parasequences? Describe also Parasequence sets and their types (20)**



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Engineering Geology
Subject: Soil Mechanics
PAPER: GEOL-438 G4

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All carry equal marks.

- Q.1 What do you know about soil mechanics and how in industry it is applied? (15 Marks)
- Q.2 What type of distinctive property exhibited by coarse and fine grained soil? Broadly classify the soil into four main groups depending on its grain sizes? (15 Marks)
- Q.3 What do you know about void spaces in soil and how can we represent soil mass in phase system? Write any five useful relationships between various quantities in soil phase system. (15 Marks)
- Q.4 Write a note on soil grain particle size accumulation curve, modes, mixtures and gap-grading. (15 Marks)
- Q.5 Discuss the following in detail.
- i. The depth soil should be investigated for engineering projects. (7.5 Marks)
 - ii. Record of soil survey with an example of any cross-section showing exploratory holes and plotted log data on it. (7.5 Marks)
- Q.6 How pressure and stress is distributed from particle to particle in soil? (15 Marks)
- Q.7 Concisely explain consolidation and settlement. What do you know about shearing strength related to friction and cohesion? (15 Marks)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

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Roll No.
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Specialization: Paleontology and Stratigraphy
Subject: Invertebrate Paleontology
PAPER: GEOL-439 G2

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Instructions: Attempt any FIVE questions. All questions carry equal marks.
Draw figures where necessary.

- Q-1.** Write a note on Precambrian Trace Fossils. Explain Paleontology of the
PRECAMBRIAN / CAMBRIAN Boundary. (15)
- Q-2.** Discuss in detail the morphology and classification of Tabulate Corals. (15)
- Q-3.** Explain detailed morphology of the order Graptoloidea. (15)
- Q-4.** Classify marine Bryozoans. Also differentiate their morphological features. (15)
- Q-5.** Describe morphology of Trilobites and discuss their modes of life. (15)
- Q-6.** Explain morphological features of the class Blastozoa. (15)
- Q-7.** Classify phylum Brachiopoda; also explain their morphology. (15)
- Q-8.** (a) What are Ammonoids? Explain the evolutionary history of Ammonoid suture. (8)
(b) Describe Ammonite hard-part morphology in detail. (7)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Engineering Geology

Subject: Seismotectonics

PAPER: GEOL-439 G4

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q. 1(a). Discuss body and surface waves with respect to their amplitude and frequency and how surface wave are more destructive. (8)
- Q. 1(b). Discuss how we can calculate the epicenter of an earthquake? (7)
- Q. 2(a). Discuss how we can differentiate between natural earthquakes and blasts? (7)
- Q. 2(b). Discuss different types of earthquake magnitude scales and their empirical relationships in detail (8)
- Q. 3. Write a note on Probabilistic seismic hazard analysis and how probabilistic seismic hazard technique is more accurate than deterministic method. (15)
- Q. 4(a). Differentiate between earthquake magnitude and intensity also discuss the different divisions Mericalli intensity scale. (8)
- Q. 4(b). Define and explain different factor which are helpful to estimate building codes. (7)
- Q. 5(a). Discuss the relationship between earthquake depth distribution and plate boundaries (8)
- Q. 5(b). Write a note on Main boundary thrust also discuss the major earthquakes associated with this thrust (7)
- Q. 5(a). Define and explain foreshocks, aftershocks and Earthquake swarms. (5)
- Q. 5(b). What is fault plan solution what are the key points of fault plane solution? (10)
- Q. 6. Discuss the major seismically active zones of Pakistan. (15)
- Q. 7. Discuss the importance of seismotectonic study for mega engineering structures. (15)
- Q. 8. Define and explain Hooks Law and elaborate Longitudinal strain, transverse strain and position ratio (15)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Petroleum Geology
Subject: Petroleum Engineering & Geophysical Methods
PAPER: GEOL-439 G5

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

Q. 1. Describe logging, discuss the electric logging and give the uses of Gamma Log.

Q. 2. Describe the followings:

- a) How drilling fluid properties effect penetration rate
- b) Cementing job

Q. 3. Write note on

- a) Fresh water Muds
- b) Rotary bits
- c) Formation cutting

Q. 5. Write down a significant note on role of drilling fluid (mud) in well drilling process.

Q. 6. Discuss the blowout and its causes.

Q. 7. What is a rig? Discuss its components.

Q. 8. What is mud logging? Explain in details.



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Mineralogy and Petrology
Subject: Sedimentary Petrology
PAPER: GEOL-440 G1

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Q. 1 Briefly explain any SIX questions from the followings;

6×5=30

- I. What is the importance of sedimentary structure?
- II. How tectonic setting affects sediment accumulation?
- III. What are the factors that control the depositional process and resulting sediments characteristics?
- IV. How we study of sedimentary rocks in field and Lab?
- V. What is difference between Bouma's model and Hsu's model?
- VI. What is effect of climate and relief on weathering?
- VII. What is difference between mature and immature sandstone?
- VIII. What are sedimentary basin and its types?

Attempt any THREE questions from following;

15 ×3=45

Q.2: Explain Dunham and Folk Classification of limestone.

Q.3 Summarize the relationship of porosity, permeability and texture.

Q.4 Explain diagenesis in detail.

Q.5 Explain sedimentary structures with the help of diagram.

Q.6 Explain Siliciclastic rocks and its types.



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

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Roll No.
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Specialization: Engineering Geology
Subject: Engineering Geology
PAPER: GEOL-440 G4

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

NOTE: Attempt any FIVE questions. Each questions carries Fifteen marks.

- Q.1 Discuss various methods of tunnel support in different rock types.
- Q.2 Define the term concrete mix design. Discuss its components in detail.
- Q.3 How sampling is executed by reverse rotary drilling method? Give its significance in geotechnical investigations.
- Q.4 Suggest, how can you identify the slope failure type.
- Q.5 Give procedure to access the suitability of coarse aggregate by using physical tests.
- Q.6 Discuss various problems associated with dams, suggest their remediation.
- Q.7 What is the Significance of Electrical Resistivity (ER) survey in ground water management investigations?
- Q.8 Write a note on
- a) Leaky aquifers
 - b) Darcy's law



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Petroleum Geology
Subject: Reservoir Geology
PAPER: GEOL-440 G5

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Attempt Any THREE Questions:

1. a). Porosity, Permeability and Bulk Density depend on some fundamental properties of rocks. Discuss (20)
b). Is there any difference between facies selective and fabric selective characteristics? (5)
2. a). Tertiary properties of rocks are measured indirectly by Geophysical tools. Discuss. (20)
b). What is meant by transition zone in a reservoir? (5)
3. a). Write an essay on petrophysical properties of clastic reservoirs. (20)
b). What methods might be used to predict the size and shape of slope-toe reservoirs? (5)
4. Describe Depositional rock characteristics of: (25)
 - i) Tidal flat environment
 - ii) Beach dune environment
 - iii) Basinal environment
5. Describe petrophysical properties of Khewra Sandstone. (20)
b). What type of fracture would you expect to find on the crest of an anticline? What will be their effect on porosity? (5)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Mineralogy and Petrology

Subject: Advanced Mineralogy

PAPER: GEOL-441 G1

TIME ALLOWED: 3 hrs.

MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

1. Describe the chemistry and paragenesis of mica group.
2. What are chain silicates? Discuss the variation in pyroxene structure.
3. Describe the optical and physical properties of calcite with its paragenesis.
4. Give a detailed account on structure of alkali feldspar.
5. Write down the general formula of calcic amphibole. Name its minerals and discuss their distinguishing features.
6. Describe the diagnostic features of the garnet group species.
7. What are sulphides. Discuss any one of sulphide in detail.



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

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Roll No.
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Specialization: Paleontology and Stratigraphy
Subject: Palynology and Paleobotany
PAPER: GEOL-441 G2

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q1. Explain the importance and applications of Palynology in Oil Industry?
- Q2. What are spores? What are their different types? What are their functions and applications in the study of sedimentary rocks?
- Q.3 What are Acritarchs? Explain their classification and importance in geology?
- Q.4 What are Dinoflagellates? Give their comprehensive classification and the importance in geology?
- Q5. Describe the standard techniques of collection and preparation of samples in palynology?
- Q.6. Differentiate between Pollens and spores? Give a comprehensive account of the composition and wall structure of the pollen and spores?
- Q.7. Give a comprehensive account of about the suprageneric classification of Trilete Spores?
- Q.8. Write a comprehensive note on the morphological description of Pollen and Spores?
Explain with diagrams the different terms used in the description of Pollen and Spores?



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Geophysics
Subject: Electrical Methods and Bore-Hole Geophysics
PAPER: GEOL-441 G6

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

NOTE: Question No. 1 is compulsory. Attempt any THREE questions from the remaining.

- 1 (a) Define any SIX terms 2*6
Dim spots, Transition zone, Net to gross ratio, Flushed Zone, Mud cake, Cementation factor, Photo-electric absorption effect, Bed resolution, Formation Characterization
- 1 (b) Give the short answers of any SIX questions. 2*6
- Write the factors which helps to provoke the radioactivity in the rocks?
 - How the SP curve is affected by shaliness in the formations?
 - Differentiate between simple and spectral gamma ray logs?
 - Write down the principles of measurement of GR Log?
 - Which log is useful for fluid detection in reservoir and why?
 - Write the factors necessary to generate the self-potential (SP) during borehole logging?
 - Which logs are used for synthetic seismogram generation?
 - Does high SP deflection means more permeable bed?
 - Differentiate between the Compton scattering and photoelectric absorption effect?
 - How oil and gas formation volume factors are affected by the changes in formation temperature and pressure?
- 2(a) Explain the different kind of logs used in porosity calculation and also explain their equations used to calculate total and effective porosity? 9
- 2(b) Describe the applications of density log? 8
- 3(a) Explain the principle of Resistivity log? Discuss its applications in detail? 9
- 3(b) A well is drilled through a hydrocarbon-bearing formation which is at its irreducible water saturation and it has a porosity of 22%. Rock core data indicates that ($a=0.81$, $m=2$, and $n=2$). The mud used for drilling is water-base, with a salt concentration (NaCl) of 50,000 ppm. The connate water has a salt concentration (NaCl) of 20,000 ppm. The shallow and deep resistivity logs readings are 12 ohm-m and 50 ohm-m respectively. The formation temperature is 145 deg F. What is the hydrocarbon saturation of the formation? 8
- 4(a) What do you means by invasion and depth of invasion? Write a note on invasion profiles? 9
- 4(b) Compute the shale volume in the reservoir interval of the Lower Goru Sand by using the following data: $GR_{log} = 52.34$ API, $GR_{max} = 122.23$ API and $GR_{min} = 28.94$ API? (Use one method from three known equation) 8
- 5 (a) Describe the qualitative and quantitative application of gamma ray log? 9
- 5 (b) Write a note on Neutron Log and explain its principles of measurements? How to calculate formation porosity? 8
- 6 What is the principle of measurement of total gamma ray (GR) log and discuss the principle of working of GR tool? Write down the qualitative and quantitative applications of total gamma ray log? 17



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018

Examination:- B.S. Applied Geology

Roll No.

Specialization: Applied Geophysics
Subject: Geophysical Data Processing
PAPER: GEOL-442 G6

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Note: Attempt any ^{five} questions

- Q. 1(a) Discuss the phenomena of seismic wave attenuation (7)
- Q: 1(b) Differentiate between body waves and surface waves with reference to their Amplitude and frequency. (8)
- Q. 2(a). Elaborate different types of reflection coefficient on the basis of their Impedance contrast also highlight their classes (10)
- Q. 2(b). Define and explain intercept, gradient and Poisson's reflectivity response. (5)
- Q. 3(a). Discuss the land and marine energy sources in detail (8)
- Q. 3(b). Define horizontal and lateral resolutions also discuss the phenomena of tuning effect (7)
- Q. 4 (a). Define and explain in detail Gassman's fluid substitution modeling and how it will be helpful to improve accuracy of the reservoir. (15)
- Q. 5(a). Describe the process to create a synthetic seismogram also discuss its importance for seismic reservoir characterization (9)
- Q. 5(b). Write a note on instrumental noise and sampling rate. (6)
- Q. 6(a). Write a comprehensive note on seismic filters (8)
- Q. 6(b). Discuss the importance of accurate survey positioning in seismic data processing and interpretation (7)
- Q. 7(a). Define and explain seismic reflection and refraction method and elaborate which method is more suitable for deep reservoir exploration. (8)
- Q. 7(b). Define and explain attenuation and intrinsic attenuation. Discuss the role of attenuation in to explore low gas saturated reservoirs. (7)
- Q. 8(a). Discuss processing sequence for Dip- Move out correction. (9)
- Q. 8(b). Discuss the role of static correction in seismic data processing (6)



UNIVERSITY OF THE PUNJAB

Fourth Prof: 2nd A-2017 & A-2018
Examination:- B.S. Applied Geology

Roll No.

Specialization: Applied Geophysics
Subject: Gravity and Magnetic Methods
PAPER: GEOL-443 G6

TIME ALLOWED: 3 hrs.
MAX. MARKS: 75

Note: Question 1 is compulsory. Attempt any three questions from the remaining.

Q-1: Answer briefly any EIGHT (8) of the following questions **24**

- i. Define geomagnetic pole
- ii. What is magnetic declination?
- iii. What are isoclines and dip equator?
- iv. Define magnetic Inclination.
- v. Define magnetosphere.
- vi. Define magnetic pole
- vii. What is gal?
- viii. What is Isostasy?
- ix. Compute free air correction if station elevation is 1000 meter and base station elevation is 990 meter.
- x. What is geoid?
- xi. Fundamental theory behind gravity survey
- xii. Differentiate b/w regional gravity anomaly and residual gravity anomaly.
- xiii. What two parameters must be given to describe the Earth's magnetic field?

Q-2: Derive formulae of gravity anomaly caused by a vertical cylinder. **17**

Q-3: Discuss the effect of a nearby topographic feature on the gravity field observation **17**
while performing gravity method and what is the strategy to correct the field data (terrain correction).

Q-4: Briefly discuss the necessary corrections that must be applied on magnetic **17**
field observations in data processing phase?

Q-5: What are the components of magnetic field of Earth? Discuss in details. **17**

Q-6: Write notes on any three of the following. **17**

- i. Instrumental drift.
- ii. Earth's magnetic field when observed from space.
- iii. Applications of magnetic method.
- iv. Importance of gravity method.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Applied Geophysics

Subject: Seismic Method and Seismic Stratigraphy

Paper: GEOL-437 G6

Time: 3 Hrs. Marks: 75

NOTE: Question number ONE is compulsory.
Attempt any THREE questions from the remaining.

1 (a) Define any six of the following terms

2*6

Bandwidth, time sampling, seismic trace, Notch filter, bulk modulus, shear strain, static correction, Datum, Law of reflection, Dim spot, Normal move out correction

1 (b) Give the short answers of any six questions.

2*6

- Differentiate between seismic refraction and reflection.
- Differentiate between low cut and high cut filter.
- Differentiate between signal and noise.
- Differentiate between seismic array and seismic spread.
- What is the difference between resolution and visualization?
- Differentiate between minimum and maximum offset.
- Why the zero phase wavelet is more desirable for seismic interpretation?
- What information is stored seismic trace header?
- Differentiate between 2D and 3D seismic data.
- Differentiate between positive and negative static.

2 (a) What is the significance of seismic data acquisition? How a field geophysicist play his role to quality control in field?

8

2 (b) Convolve and cross correlate of a signal $S = -0.4, -0.25, 0, 0.5, 0.7$ to an operator $W = -0.25, 0, 0.25$. Write all steps involved

9

3 (a) What is signal-to-noise ratio? How it can play its role in seismic data quality. Write a note on seismic signals. What is the minimum bandwidth for good quality of data

17

4 (a) In a plain area a 2D seismic data acquisition is planned with 4,000 m target depth. The group interval is 50 m, minimum offset is 25 m and far offset receiver is at 5,975 m. What will be total number of channel used? The wavelength of ground rolls is 6 m in this area what will be the minimum spacing between the geophones to over-ride the ground rolls?

8

4 (b) What is the role of filtering in seismic data processing? How many types of filtering generally used? Write a note on Nyquist frequency, sampling frequency and aliasing frequency

9

5 Write a note on seismic data interpretation? Discuss different types of interpretation

17

6 (a) What is static correction? How static correction is computed and applied on seismic data? What is the significance of datum?

9

6 (b) A sinusoidal signal has only two frequency components 50 and 100 Hz. You digitized the signal using a sampling interval of 2 ms? (a) Would aliasing occur to the 50 Hz frequency component? If yes, calculate the aliasing frequency? (b) Would aliasing occur to the 100 Hz frequency component? If yes, calculate the aliasing frequency?

8



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Mineralogy and Petrology

Subject: Geochemistry

Paper: GEOL-437 G1

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks.

- Q.1. Discuss the geochemical classification of elements.
- Q.2. Explain the impacts of assimilation, crystal fractionation and partial melting on magma composition.
- Q.3. Elaborate the classification and tectonic discrimination diagrams.
- Q.4. Explain the geochemical characteristics different magma series.
- Q.5. Write a comprehensive note on chemical variation diagrams.
- Q.6. Discuss two feldspar geothermometry.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Engineering Geology
Subject: Rock Mechanics

Paper: GEOL-437 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. All questions carry equal marks.

Q.1	Discuss comprehensively the factors that can influencing uniaxial compressive strength in the laboratory.	25
Q.2	Write down kinematic conditions of a block that is likely to fall following a wedge failure mode of rock slope failure. Also provide the illustrations to portray the scenario on the stereonet.	25
Q.3	Discuss the differences among the followings with reference to rocks <ul style="list-style-type: none">• Uniaxial & Triaxial Compressive Strengths• Intact Rock & Rock Mass• Isotropy & Homogeneity	25
Q.4	Define a discontinuity, comprehensively discuss any five parameters of the discontinuities in view of their importance and measurement.	25
Q.5	Write short notes on the following parameters of rocks; <ul style="list-style-type: none">• Elastic Modulus & Poisson's Ratio• Topping mode of Rock Slope Failure• Discontinuity Surveys	25



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Petroleum Geology
Subject: Petroleum Geology

Paper: GEOL-437 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. All questions carry equal marks.

1. a) Describe different biological matters involved in generation of hydrocarbons (15)
b) Discuss Cretaceous petroleum system of the Lower Indus Basin (10)
2. a) Explain the different transporting elements which act as part of pathways for migration of hydrocarbons. (15)
b) Discuss major basins of Pakistan. (10)
3. a) Give a comparative analysis of the composite petroleum system of Kohat-Potwar and Sualiman-Kirthar geological provinces. (15)
b) Give an account on Precambrian-Cambrian plays of Upper Indus Basin. (10)
4. Explain tectonic setting, stratigraphy and anticipated hydrocarbon potential of Kashmir Basin. (25)
5. Explain the followings (25)
 - a) What is the concept of immature oil? Describe the geochemical characteristics of immature oil. (15)
 - b) Describe different macerals and HC generation potential of coal. (10)



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Petroleum Geology

Subject: Sequence Stratigraphy

Paper: GEOL-438 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All questions carry equal marks.

- Q. 1 Describe different types of basin margins.
- Q. 2 Describe role of prospect generation department in exploration companies.
- Q. 3 Describe role of E & P companies in oil industry. Name five E&P companies operating in Pakistan.
- Q. 4. Describe parasequences and explain how to mark on Gamma log?
- Q. 5. Explain in details stratal terminations.



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Engineering Geology
Subject: Soil Mechanics

Paper: GEOL-438 G4

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All questions carry equal marks.

- Q.1 (a) Discuss how the soils are formed by the environmental process of rock weathering. (10 Marks)
(b) Discuss transported and residual soil. (05 Marks)
(15 Marks)
- Q.2 Write a short note on the following.
a. Why soil particle size grading test is performed?
b. How to find uniformity coefficient (C_u) from soil particle size accumulation curve?
c. Differentiate between well vs poorly graded and well vs poorly sorted soil. (15 Marks)
- Q.3 Explain the types of expansive clays. (15 Marks)
- Q.4 Discuss the division of coarse-grained soil in a unified soil classification system. (15 Marks)
- Q.5 Write a note on stress distribution in soil. (15 Marks)
- Q.6 Discuss Mohr-Coulomb theory and failure envelopes for sand and clay. (15 Marks)
- Q.7 Discuss Terzaghi's method for the calculation of bearing capacity. (5 Marks)
- Q.8 (a) Why are soil surveys performed? (10 Marks)
(b) Write a short note on the standard penetration test.



UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Mineralogy and Petrology

Subject: Igneous Petrology

Paper: GEOL-438 G1

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All questions carry equal marks. Be brief and to the point and draw the sketch where needed.

Q. 1. Briefly discuss the chemistry, fractionation and tectonic distribution of the rock suites.

Q. 2. Differentiate between the Primary and Parental magma and outline the methods of studying igneous provinces.

Q. 3. Describe the thickness, lithology and structure of a typical Ophiolite sequence.

Q. 4. Discuss the classification of the plutonic bodies upon the base of their depth of emplacement.

Q. 5. Discuss the following:

1. Bivariate diagrams in igneous Petrology

2. Modal Mineralogical Classification of Granitoids

3. Petrography of Subduction related rocks

4. AFM Diagram

5. OIB's



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Sedimentology

Subject: Carbonate Sedimentology

Paper: GEOL-438 G8

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

- Q.1 What are carbonate minerals? Explain the genesis of Calcium Carbonate?
- Q.2 What is Dolomite? Explain the different environments and chemical conditions for the formation of Dolomite.
- Q.3 Explain the different models for the formation of Dolomite?
- Q.4 What are stromatolites? What are their different types? Explain the mechanism of their genesis?
- Q.5 Comprehensively explain the modern carbonate environment of Bahamas, Florida and Persian Gulf?
- Q.6 What are Limestones? How they are formed? Explain any two classifications of limestones?
- Q.7 Describe the different environments of deposition of carbonates with special emphasis on marginal marine and lacustrine environment?



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Engineering Geology

Subject: Seismotectonics

Paper: GEOL-439 G4

Time: 3 Hrs. Marks: 75

Q. 1 Explain any SEVEN questions from the followings;

$7 \times 7 = 49$

- I. Explain the different Myths about earthquake.
- II. What causes the earth magnetic fields?
- III. How to determine the focus of the earthquake.
- IV. Explain the primary and secondary effects of an earthquake.
- V. Explain the process of liquefaction.
- VI. What is the difference between magnitude and intensity?
- VII. What are the top five ways to cause a man made earthquake?
- VIII. What is the Richter magnitude scale?
- IX. Calculate the amount of energy released during 2001 Bhuj earthquake ($M_s=7.9$).

Attempt any TWO questions from following;

$13 \times 2 = 26$

Q.2 How probabilistic and deterministic methods are helpful in seismic study of the project area.

Q.3 Explain the different layers of the earth and their response to seismic waves.

Q.4 Define the followings;

- I) Annual probability of exceedance II) Peak ground velocity III) Seismic Gap
IV) Ring of Fire V) Fault Offset VI) Conrad discontinuity VII) Seismic Moment



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Petroleum Geology

Subject: Petroleum Engineering & Geophysical Methods

Paper: GEOL-439 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

- Q1. What are the most common tasks performed by Mud loggers, petroleum geologists, and other geoscientists in Oil and Gas Exploration and Production (E&P) companies.
- Q2. Explain different geophysical methods which are used by E&P companies to delineate the subsurface rocks. Also, describe the resolution and limitation of each geophysical methods.
- Q3. What is meant by seismic wave velocity? Explain the seismic wave velocity of different media and factors upon which seismic wave velocity depends.
- Q4. Explain the processes involved in reduction of the seismic wave amplitudes.
- Q5. Explain in detail the data derived from seismic refraction and seismic reflection and their applications.
- Q6. What is meant by the elastic modulus? Describe the numerical relationships of elastic moduli and Poisson's and V_p/V_s ratios.
- Q7. Illustrate the polarization of the body and surface waves produced during a ground shaking event. Also, describe various wave parameters used to explain such waves.



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Roll No.
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Specialization: Sedimentology
Subject: Sedimentary Petrology

Paper: GEOL-439 G8

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE Questions. All Questions carry equal marks.

- Q. 1: Define Siliciclastic Sedimentary Rock, and describe the Gilbert's classification of Sandstones.
- Q. 2: Write notes on,
- a) Particle Shape
 - b) Roundness and Sphericity
 - c) Grain packing and grain to grain relations
- Q. 3: Discuss the classification of Mud Rocks by Potter (1980).
- Q. 4: Describe the followings
- a) Continental Block Provenance
 - b) Magmatic-arc Provenance
 - c) Recycled-orogen Provenance
- Q. 5: Describe the major constituents of Carbonate Rocks. Discuss the classification of Carbonate Rocks by Dunham (1962).
- Q. 6: Describe the followings,
- a) Heavy Minerals
 - b) Conglomerates
- Q. 7: Define diagenesis, describe the major diagenetic processes in carbonate rocks.
- Q. 8: Discuss the followings,
- a) Phosphate Deposits
 - b) Types of Chert



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Mineralogy and Petrology
Subject: Sedimentary Petrology

Paper: GEOL-440 G1

Time: 3 Hrs. Marks: 75

**NOTE: Attempt any THREE Questions. All Questions carry equal marks.
Support your answers with help of figures and diagrams.**

- 1- How are sandstones formed? What is basic composition of sandstone. Describe with figures.
- 2- Describe the basic composition of carbonate rocks, what is Dunham classification?
- 3- How grain size, grain shape, sorting, and grain packing impact physical properties of rock?
- 4- How Porosity develops in sedimentary rocks? What are the porosity types in carbonate rocks?
- 5- What are the mudrocks and how they are classified based on their composition?

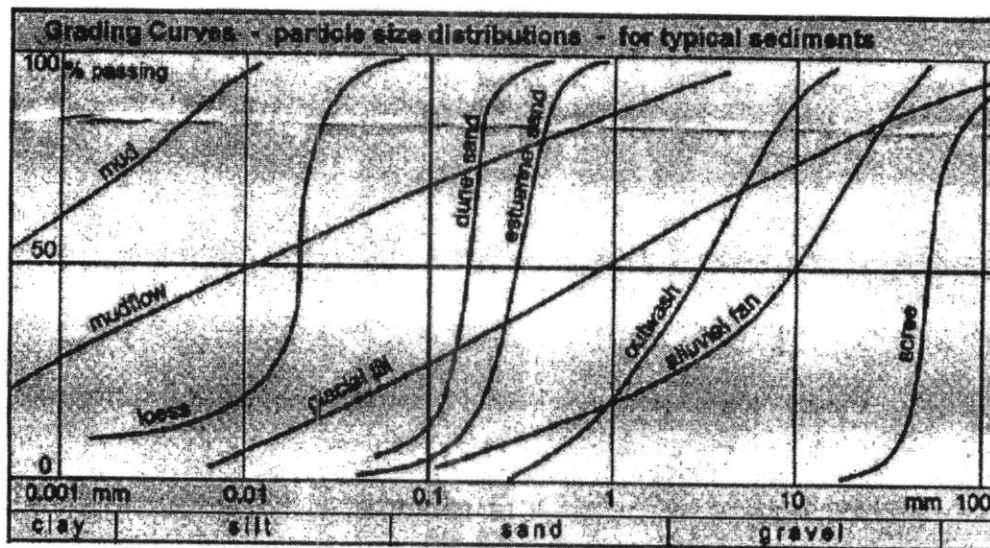


NOTE: Attempt any FIVE Questions. All questions carry equal marks.

Question 1: (a) Describe Strength of the Ground with example of natural materials. What is basic criteria and properties for the assessment of rock condition in the field? (10)

(b) Give comparative description of Strong Rocks and Weak Rocks. (5)

Question 2: What is particle distribution curve? Characterize the curves from left to right in the following graph. (15)



Question 3: Write a note on Ground Investigation, its objectives and methods. (15)

Question 4: Define engineering structure of dam, characterize its types. Discuss in detail the various engineering geology implications to the selection of site for a dam. (15)

Question 5: Define the process of landslide, provide nomenclature used for its description/mapping with the help of sketch. (15)

Question 6: What is a foundation? Describe the types of shallow foundations and deep foundations with sketches and setup of acting forces. (15)

Question 7: Write a note on the three modes of soil failure under foundation with graphical illustrations. (15)



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Petroleum Geology
Subject: Reservoir Geology

Paper: GEOL-440 G5

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All questions carry equal marks.

1. Discuss the sandstone reservoir rocks.
2. Define porosity and describe the effective porosity and also describe the methods to measure the effective porosity.
3. Define permeability and discuss the method to measure the permeability.
4. Discuss the reservoir rocks of Pakistan.
5. Define diagenesis and describe the major diagenetic processes in limestone and its effects on porosity.



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Sedimentology

Subject: Basin Analysis

Paper: GEOL-440 G8

Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE Questions. All Questions carry equal marks.

Question 1: What is the tectonic association of sedimentary basins and their origin? Explain types of basins associated with transform boundary.

Question 2: Discuss the role of basin evolution on the characteristics of petroleum system. Also describe the role of changes in basinal settings on source and reservoir rock evolution.

Question 3: The mass of hydrocarbon generated by active source rock can be estimated by using analytical method proposed by Schmoker (1994). Calculate total mass of hydrocarbon generated in kilograms by using following.

Given Data:

a. Density of rock = 2.4 g/cm^3

b. Volume of unit = length * width * height

Where length of the unit = 760 m, height = 80 m and width of the unit = 120 m

c. Original HI = 200 mgHC/gTOC

d. Present HI = 161 mgHC/gTOC

Question 4: Define basin analysis and write a detail note on source rock screening for any remote area. Please elaborate your point of view with example.

Question 5: Write comprehensive note on the following topics.

- Basin types associated with divergent plate boundaries
- Significance of burial history in understanding basin evolution



UNIVERSITY OF THE PUNJAB
B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Mineralogy and Petrology
Subject: Advanced Mineralogy

Paper: GEOL-441 G1

Time: 3 Hrs. Marks: 75

Note: Attempt any THREE questions. All questions carry equal marks.

- Q.1. Discuss the feldspars.
- Q.2. Explain the structure and polymorphism in silica group of minerals.
- Q.3. Explain the various classes of amphibole group.
- Q.4. Elaborate chemistry, structure and classification of olivine group.
- Q.5. Write a note on sulphate group of minerals.
- Q.6. Explain the various mineral varieties of oxides.



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Applied Geophysics
Subject: Geophysical Data Processing

Paper: GEOL-442 G6

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE questions.

Q. 1 (a) Elaborate Coherent and incoherent noise with examples. (7)

Q1 (b) Explain the different process of seismic data processing specifically mechanical and interactive process. (8)

Q. 2(a) Elaborate how seismic velocity attenuation and dispersion plays a vital role in seismic based hydrocarbon exploration. (9)

Q: 2(b) How amplitude and frequency effects the velocity of body waves and surface waves describe in detail (6)

Q. 3(a). Describe in detail NMO and static correction (7)

Q. 3(b). Describe in detail layout of demultiplexing (8)

Q. 4. What AVO technique and discuss in detail different AVO classes and their role in hydrocarbon identification. (15)

Q. 5(a). Define and explain application of AVO parameters i.e. intercept, gradient and Poisson's ratio. (9)

Q.5 (b). What is Signal to noise ratio and explain its role to obtain good quality data. (6)

Q 6a Discuss any two of the following w.r.t geostatistics (9).

- a) Sample standard deviation.
- b) Interpolation and contouring.
- c) Least squares Polynomial vs Triangulation.

Q 6b. What is meant by seismic velocity attenuation and dispersion? how its importance in vertical and horizontal resolution of seismic reflectors (6)

Q 7. Briefly explain/discuss the followings and give empirical relations where necessary; (15)

Ricker Wavelet, Reflection Coefficient, P-wave impedance & S- wave impedance, Convolution & de-convolution, sampling theorem.



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Geophysics

Subject: Electrical Methods and Bore-Hole Geophysics

Paper: GEOL-441 G6

Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE questions.

Q. 1. How elastic parameters will helpful for reservoir characterization and rock physics modeling, elaborate in detail. 15

Q. 2 Define and explain vertical seismic profile, its application in detail and elaborate the following types of VSP. 15

(i) Zero offset VSP

(ii) Offset VSP

(iii) Walk away VSP

(iv) Walk above VSP

(v) Salt Proximity VSP

Q. 3 (a) Write a note on schlumberger configuration (5 Marks)

(b) Explain the basic working principle of electromagnetic (EM) induction method, EM advantage on resistivity method and types of EM systems. [5]

(ii) Explain the types of frequency domain electromagnetic instruments, coil separation, working frequency, investigation depth etc. [5]

Q4 (a); Write a note on zone of invasion also discuss their effect on resistivity logs (considering water bearing reservoir) (10Marks)

Q4 (b); Write a note on breakouts (5Marks)

Q5 (a); Write a note on spectral gamma ray tools (5 Marks)

Q5 (b); Discuss the role of Th/K ratio in minerals and depositional environmental identification (10Marks)

Q6 (a); Discuss the qualitative and quantitative use of density log (10 Marks)

Q6(b); Write a note on pressure environments of borehole logging (5 Marks)

Q7 (a); Discuss the role of Archie equation in basic petrophysical analysis (6 Marks)

Q7 (b); Discuss the principles of measurement of SP log (9 Marks)



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B.S. Applied Geology / Fourth Prof. Annual 2021

Roll No.

Specialization: Applied Geophysics

Subject: Gravity and Magnetic Methods

Paper: GEOL-443 G6

Time: 3 Hrs. Marks: 75

NOTE: Question No. 6 is compulsory. Attempt any **THREE** Questions from the remaining.

- Q-1:** If a sphere of ore body having, mass " M ", volume " V ", density " ρ ", radius " R " and is located at a depth of " Z " from the surface of earth, then derive an expressions for its gravity anomaly, and for its depth and mass calculation. 17
- Q-2:** Derive the expressions for gravity anomaly caused by an infinite horizontal cylindrical body and for its depth " Z " (from the surface) calculation. 17
- Q-3:** Discuss in detail rock magnetism and its types. 17
- Q-4:** Discuss in detail, the necessary corrections that must be applied on magnetic field observations in data processing phase. 17
- Q-5:** a). Discuss in detail the structure of magnetic field of the Earth, when we observed it from the space. 9
- b). Discuss in details the causes of instrumental drift with time, and how these effects can be removed during gravity data processing. 8
- Q-6:** Write short notes on any Four of the following. (4X6=24)
- Gravity Profile
 - Magnetic elements
 - Magnetic pole reversal
 - Why Terrain Correction is needed in data reduction?
 - Write factor affecting density of sedimentary material.
 - Compute Free Air Correction for elevation 20 meters w.r.t. base.
 - Origin of magnetic field of the Earth.