UNIVERSITY OF THE PUNJAB

Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Communication Skills & Technical Report Writing
PAPER: I / ENG-202

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 100

NOTE: Attempt All questions.

Q#1: Read the following passage and answer the questions that follow. /10

Geology from the Greek geo (Earth) and logos (discourse) is that branch of physical sciences which deals with the study of the earth, including the materials that it is made of, the physical and chemical changes that occur on its surface and in its interior, and the history of the planet and its life forms. It also studies the ocean floor, and the interior of the earth. Geologists investigate the composition of earth materials and various geological processes to locate and exploit its mineral resources. They investigate geological phenomena such as earthquakes and volcanoes and attempt to predict and minimize their damaging effects.

Geology, or geoscience, is the study of the Earth. Not only do geologists address academic demands such as the formation and composition of our planet, the causes of earthquakes and ice ages, and the evolution of life, but they also address practical problems such as how to keep pollution out of groundwater, how to find oil and minerals, and how to avoid landslides. The complex science of geology is not a mere study of earth superficially, but it includes an inestimable amount of science which is involved in it from the present day climate change to even before the formation of the solar system as it contemplates on the origin of universe and solar system and has gained a great success in finding their original cause of formation along with the reason of the formation of the earth on the one hand and on the other hand has provided a significant evidence of the present day climate change, environmental degradation, air and water pollution as not being only an anthropogenic affair but beyond that .

This subject accumulates events that the Earth has witnessed for more than 4.5 billion years, like the formation of the mineral resources (the back bone of modern society), the origin and evolution of the life, the evolution of atmosphere, and causes of disappearance of so many great organisms from the earth as a function of the varying environment. This time-span of million years and associated events and their causes and consequences are preserved on the earth as the pages in a book. The fascination of geology attracts many to careers in this science. Tens of thousands of geologists work for oil, mining, water, engineering, and environmental companies, while a smaller number work in universities, government geological surveys, and research laboratories. Recent developments in geology have further broadened its expanses into medical and health sciences with a new emerging field of medical geology growing very fast. There are countless fields where geological knowledge is a prerequisite to achieve a technologically sound society.

i. What does geology help us understand about our planet Earth?

ii. Why do geologists investigate geological phenomena such as earthquake?

iii. How geology is a study of past or history?

_____

_____

_____

iv. What kinds of career opportunities are available to geologists?

_____

_____

_____

v. Write the most appropriate title of the passage.

_____

_____

Q#2: Read the text carefully and choose most appropriate word from the word bank. /10

Word Bank:

Mars crust crater miles	summit rock lava cracks	Magma Earth volcano erupts

A volcano is a place on the Earth's surface (or any other planet's or moon's surface) where molten _____, gases and pyroclastic debris erupt through the earth's _____. Volcanoes vary quite a bit in their structure - some are _____ in the earth's crust where lava erupts, and some are domes, shields, or mountain-like structures with a _____ (a circular depression) at the summit.

_____ is molten rock within the Earth's crust. When magma _____ through the earth's surface it is called _____.

The largest volcano on Earth is Hawaii's Mauna Loa. Mauna Loa is about 6 miles (10 km) tall from the sea floor to its _____ (it rises about 4 km above sea level). It also has the greatest volume of any volcano on Earth, 10,200 cubic miles (42,500 cubic kilometers).

The largest _____ in our Solar System is perhaps Olympus Mons on the planet _____. This enormous volcano is 17 _____ (27 km) tall and over 320 miles (520 km) across.

Q#3: For each question, fill the space in the sentence using the base word given in bold at the end. The required word may be a noun, adverb, adjective or verb or any other grammatical form. /10

i. Minerals influence and respond to physical, chemical, and biological processes ..... throughout the Earth. **(Operate)**

ii. The study of the ..... of the rocks in the earth's lithosphere is the subject matter of the branch of geology known as structural geology. **(deform)**

iii. Historical Geology is that branch of geology that studies the..... history of the earth in a chronological manner. **(evolution)**

iv. Engineering geology deals with the..... of geology to engineering practices and solving engineering problems. **(apply)**

v. Arabs were the first people along with romans to recognize the ..... of the surface processes. **(important)**

vi. Eratosthenes, a librarian at Alexandria at about 200 BC, made surprisingly accurate ..... of the circumference of the earth by plotting the angles. **(measure)**

vii. .....of geology as a separate branch of science took place in the years between 1775 and 1830. **(Develop)**

viii. There are considerable opposition to the..... method of calculating the ages of minerals and rocks, both from religious authorities and from physicists. **(geology)**

ix. Physicists made the..... that the earth began as a molten mass and was in process of cooling.**(assume)**

x. According to a hypothesis, the sun existed before the formation of the ..... system. **(planet)**

Q#4: Complete the following sentences either by adding a dependent clause or independent clause given in the options (a-e). /05

i. As the larger star came closer and closer ..... and caused imbalance in the sun

ii. Igneous rocks are also called primary rocks .....

iii. The whole ideas of build the dam will become useless .....

iv. The ground may start to pitch .....

v. Although landslides usually occur on steep slopes, ...

a. the size of the tides increased (due to increased gravitational attraction).

b. because these are formed on earth crust

c. if the foundation on which the dam is built is the porous or permeable

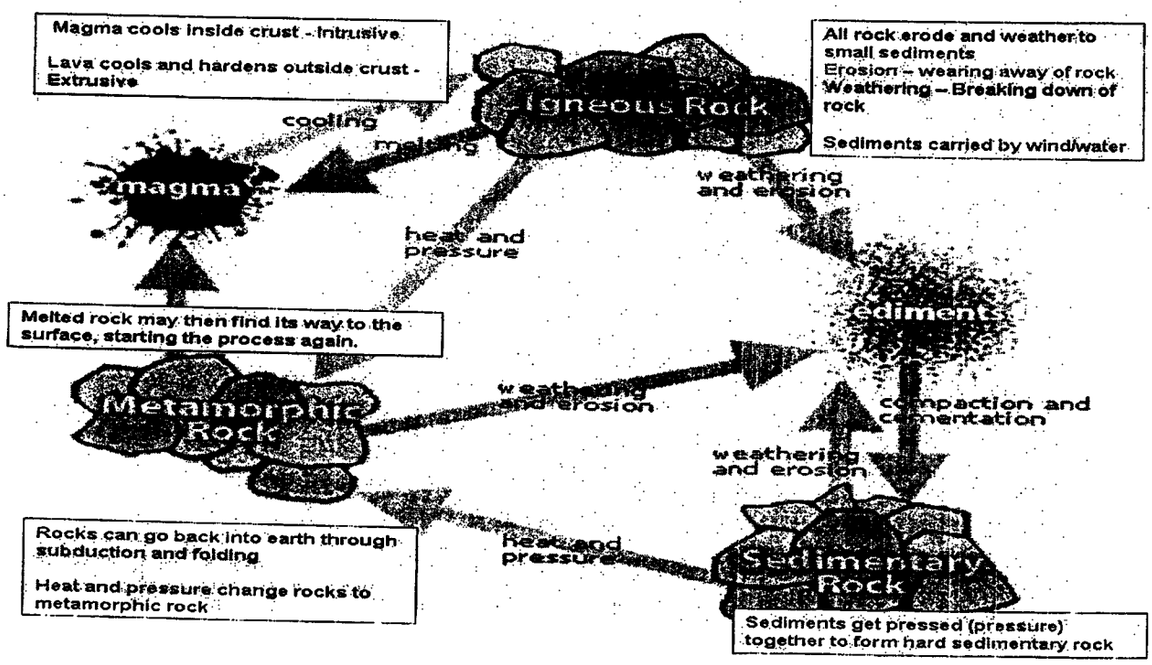
d. and roll likes a ship for several seconds to several minutes

e. they also can occur in areas of low relief.

Q#5: Complete the following comparison table of Fact and Opinion. /10

Sr#	Basis for comparison	Fact	Opinion
1.	Meaning		
2.	Based on		
3.	What is it?		
4.	Verification		
5.	Represents		
6.	Change		
7.	Words		
8.	Debatable		
9.	Influence		
10.	Example		

Q#6: Look at the following cycle of different rock formation and describe it in your own words. /10



Q#7: Look at the phonemes and decide which word it is. /5

1. /k/ /æ/ /t/

   a) Cat b)cut c) kit d) cot

2. /l/ /u:/ /p/

   a) Loop b) lop c) lip d) leap

3. /b/ /əʊ/ /t/

   a) Boot b) bat c) bate d) boat

4. /s/ /e/ /d/

   a) Sad b) sod c) said d) sud

5. /d/ /e/ /t/

   a) Date b) debt c) duty d) doubt

Q. 8 Read the paragraph carefully and correct it technically in all aspects. (20)

The salt range/Potwar Plateau (SRPP) are part of himalayan foreland and an important petroleum province in North Pakistan. The hydrocarbons is commonly produced from stacked cambrian to Eocene clastic and carbonate reservoirswhich haveanaverage thicknessof1km.These strata are overlain by at least 5 km of Miocene and younger continental molasse sedimentation in the deepest part of the foreland basin. Surface and subsurface (seismic interpretations and borehole data) Geology combine with the timing and the patterns of sedimentation has allow to interpret the deformation as thin skinned, with a detachment in weak Eocambrian evaporates and the development of ramp-andflat structures, since about 8 Ma. We have reviewed the structural interpretations with new borehole logs, field geology, and reserve estimates in this paper to precisely define oilfield structures with a view on future exploration. As a result of this work, 12 oil fields are classified as three detachment folds, four fault-propagation folds, four pop-ups, and one triangle zone structure. The latter two are identified as better prospects with the last one as the best with estimated reserves of 51 million barrels of oil (MMBO). Hence, the triangle zones along with other ramp-and-flat structures from the North Potwar Deformed Zone (NPDZ) are recognized to provide potential future prospects. Finally, a 40-km-long structuralcrosssectionfromNPDZisusedtodiscusscomplex deformation of the triangle zone and duplex structures as future potential prospects. About 55 km of shortening across the NPDZ during Plio-Pleistocene time is calculated, which has important bearing on the geometry of prospects, reserve calculations, and the future exploration.

Q. 9 Explain main contents of a technical report. (20)

UNIVERSITY OF THE PUNJAB

Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Mathematics II
PAPER: II / MATH-202

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 100

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

1. Solve the following differential equations:

   (a) $(D^3+1)y = 1+e^{-x}+e^{2x}$. (10 marks)

   (b) $(D^3-4D^2+D+6)y = 0$. (10 marks)

2. Solve the following differential equations:

   (a) $(D^3+D^2-4D-4)y = e^{2x}\cos 3x$. (10 marks)

   (b) $(D^3-27)y = 0$. (10 marks)

3. Given that $\frac{dy}{dx} = \frac{1}{2}(x+y)$, $y(0)=0$, $y(0.5)=2.636$, $y(1.0)=3.595$, $y(1.5)=4.968$, Find $y(2)$ by Adam's Bashforth predictor method. (20 marks)

4. (a) Find a root of $\sin x = 1+x^3$ correct to 3 three decimal places using Newton Raphson method: (10 marks)

   (b) Find a root of the equation $\sin x = 5x-2$ correct to three decimal places by bisection method in $(0,1)$. (10 marks)

5. (a) Find the cube root of 2 by simple iterations. (10 marks)

   (b) Find a root of $2x^3+4x^2-3x-5$ near to 1.0 correct to three decimal places by simple iterations method. (10 marks)

6. (a) Show that

$$\int_0^{+\infty} e^{-x^2}dx = \frac{\sqrt{\pi}}{2}.$$

   (10 marks)

   (b) Find the inverse Laplace transform of **(10 marks)**

$$\frac{s+4}{s^2+3s+2}.$$

7. (a) If $f(t)$ and $f'(t)$ are continuous and $f''(t)$ is piecewise continuous on the interval $[0,\infty)$, and all are of exponential order, i.e. both of order $e^{\alpha x}$, then (10 marks)

$$\mathcal{L}\{f''(t)\} = s^2F(s) - sf(0) - f'(0).$$

   (b) Show that $\mathcal{L}\{f(at)\} = \frac{1}{a}\mathcal{L}\{f(t)\}$, where $a>0$ is a constant number. (10 marks)

8. (a) Find the Laplace transform of the function $f(t) = \cos kt$, where k is constant. (10 marks)

   (b) Calculate the Laplace transform of the function $f(t) = t^3$. (10 marks)

UNIVERSITY OF THE PUNJAB

Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Physics II
PAPER: III / PHYS-203

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 75

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

1 (a) Define any 6 of the following terms 2*6

Refraction, Entropy, Ideal gas, Photon, Bulk modulus, electrical conductivity, shear strain, Reflection coefficient, seismic source

1 (b) Write short answer of any 6 questions. 2*6

I. Differentiate between volumetric stress and longitudinal stress
II. Differentiate between isochoric and isobaric process
III. Differentiate between force and stress?
IV. Differentiate between volumetric heat capacity and specific heat capacity
V. Differentiate between active and passive methods?
VI. Why electrical resistivity of sedimentary rocks is lower than of igneous rocks?
VII. Write two applications of seismic reflection method.
VIII. Why electrical resistivity method is more recommendable for groundwater investigations?

2(a) Differentiate between stress and strain. What is elasticity? Write down the applications of seismic methods in Geology and Geophysics? 2+3+4

2(b) Justify following statements for an isothermal process 8

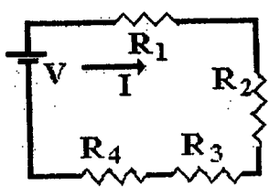
A $\Delta U=0$. B $\Delta Q=\Delta W$, C $PV=$constant

3(a) Write a brief note on wave interference? Describe its types. Elaborate your answer with appropriate diagrams. What is the significance of interference in our daily life? 4+3+1+4+1

3(b) Why seismic reflection method is recommendable for deep subsurface exploration? Write down the principle of seismic reflection. 2+2

4(a) Discuss in detail electrical resistivity method 9

4(b) The current flowing in a circuit containing four resistors connected in series is I = 1.0 A. The potential drops across the first, second and third resistors are, respectively: V = 5 V, V = 8 V and V = 7 V. The equivalent resistance of the circuit is R = 30. Find the total voltage supplied by the battery and also current, voltage drop, and resistance of each resistor in the circuit. 8



5 What do you means by radioactivity? How many types of radiations exist in nature? Write down the characteristics of each type? What are the significance and uses of radioactivity in Geology and Geophysics? 17

6(a) What is the principle of Self-potential method? Write down its types and application. 2+3+5

6(b) A saxophone is playing a steady note of frequency 321 Hz at room temperature. Suppose that at some instant the varying pressure at your eardrum is at a maximum. How far away in meters is the next pressure maximum? 7

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Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Chemistry II **TIME ALLOWED: 3 Hrs.**

PAPER: IV / CHEM-203 **MAX. MARKS: 75**

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

Sr #	Question	Marks
1	What is 2nd law of thermodynamics? Define Entropy and explain entropy change in reversible and irreversible processes	15
2	a) What types of stationary phases are used in GC? b) What types of transitions are encountered in molecule? c) Explain Kyanite-andalusite and sillimanite system.	5 5 5
3	a) What is the principle of Atomic Emission Spectroscopy? Draw the block diagram and explain the working of Monochromator. b) Explain the working of Thermal conductivity detector.	10 5
4	a) What is radioactivity? How Radiations are measured? Explain any two methods b) Discuss the Principle of Mass Spectrometry	12 3
5	a) What is the function of Flame in Atomic Emission Spectroscopy? Explain it. b) What are radioisotopes give its applications.	7 8
6	a) What is Beers Lambert Law? Derive and Expression for it. b) Differentiate between I. Chromophore and auxochrome II. Bathochromic effect and hyperchromic effect III. Transmittance and Absorbance IV. Lamda max and molar absorbtivity	7 8
7	Prove that : Cp - Cv= R	15
8	a) What are the applications of AAS,AES, and UV-Visible Spectroscopy b) What is Nuclear fission process ,explain with examples	9 6

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Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Stratigraphy of Pakistan
PAPER: V / GEOL-209

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 75

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

Q.1. What are Sedimentary Basins? Explain their different types?

Q.2. Describe the stratigraphy of Nammal Gorge?

Q.3. Explain the Paleocene system of Northern Pakistan?

Q.4. Explain the Permian system of Pakistan?

Q.5. Write notes on the following:

i). Datta Formation
ii). Hangu Formation
iii). Mianwali Formation

Q.6. What is stratigraphic correlation? Explain its different types?

Q.7. Briefly explain the followings:

i). Shrinab Formation
ii). Parh Limestone
iii). Lockhart Limestone

Q.8. What are the different branches of Stratigraphy? Explain the lithostratigraphy and Biostratigraphy in detail?

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Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Computing & Geostatistics
PAPER: VI / COMP-201

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 50

NOTE: Attempt any THREE questions while Question No. 1 is Compulsory.

1 (a)	**Define any FIVE terms and also give examples or diagrammatic representation?** Ordinal scale, Uniform Resource Locator, Standard error, Median, Probabilistic approach, Statistical population, Web site	2*5
1 (b)	**Give the short answers of any FIVE questions and also draw figures where it is necessary?** i. What is the secret behind the Web and also write down its drawbacks? ii. What is the difference between mathematics and statistics? iii. What is the difference between internet and web? iv. How the concept of data sampling in statistics is important? v. Who invented the web and what was the objective behind its invention? vi. What is the difference between simple bar charts and multiple bar charts? vii. Write the difference between quartiles, deciles and percentiles?	2*5
2(a)	Discuss the role of computer applications for geologists?	5
2(b)	How geostatistics works and describe its applications in reservoir charactization?	5
2(c)	Describe the various methods used to collect the primary and secondary data is statistics?	5
3(a)	Describe the various 1D interpolation methods used interpolate the geological data and how statistics help us in this regard?	7.5
3(b)	Write a comprehensive note on Charles Babbage 'Analytical Engine' and its specifications also discuss the role Ada – Countess of Lovelace in the designing of Analytical Engine?	7.5
4(a)	What is the normal or Gaussian distribution curve? Write a detail note on normal distribution curve and also discuss its mathematics?	7.5
4(b)	Discuss in detail the impact of web on following: (a) Internet Browsers (b) Web Search Engines (c) World Wide Web	7.5

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Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Survey & Mapping Techniques **TIME ALLOWED: 3 Hrs.**

PAPER: VII / SURV-201 **MAX. MARKS: 50**

NOTE: Attempt any THREE questions.

Q. 1. A) Explain the different types of maps on the basis of cultural features and how we give a number to a top sheet. (7,5,5)

B) Write down the differences between the Gamma Ray Log and Resistivity Log.

C) Define the followings

I) Scale II) Adit III) Cartography IV) Horizontal equivelent V) Hade of a fault

Q. 2. A) What are the different geological structures related to the Tunnel alignments? (6,6,5)

B) Explain uses of contours.

C) What are the different types of drillings and where we prefer these types?

Q.3. A) Briefly explain the role of mapping in different fields of geology. (5,6,6)

B) How the parallels and meridians appear on the globe.

C) Explain the different types of scale.

Q.4. A) Plot the following Geological features with the help of contour (6,5,6)

I) undulating slope II) Plateau III) Cliff VI) Water Fall V) V shaped valley VI) Gorge

B) What are the different applications of total station?

C) Explain the Litho correlation.

Q.5. A) What are the basis steps in the setting up the plane table survey. (6,5,6)

B) Advantages and disadvantages of GPS.

C) I) Find out the R.F of the map which is drawn to the scale 4cm to 2 km.

II) Find out the statement of the scale if the distance between two points on the map is 1.25 cm. The distance between same two points on the ground is 2.5 km.

UNIVERSITY OF THE PUNJAB

Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Petrology
PAPER: VIII / GEOL-210

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 75

NOTE: Attempt any THREE questions. Be brief and to the point and draw the sketches where needed.

Q. 1.

a. Discuss the classification of the rocks upon the base of the Silica content. 10

b. Discuss chemical variation diagrams and their uses in categorizing magma type 8

c. Briefly discuss the Burial Metamorphism 7

Q. 2.

a. Illustrate the two component phase diagram with complete solid solution series 10

b. What is the protolith of Phyllite, greenstone and marble? What processes produce the outcrop of blueschist at the surface of the earth? 7

c. Discuss the Classification for Pyroclastic Rocks upon the base of particle size. 8

Q. 3.

a. Enlist the major textural classes of the igneous rocks. 10

b. Discuss the Dunham Classification of the Carbonate Rocks 10

c. Discuss the Plastic Intracrystalline Deformation textures in Metamorphic rocks 5

Q. 4.

a. Discuss the Classification of Rudites 8

b. What tectonic processes produce outcrops of ophiolite at the earth's surface. Also discuss its composition and structure. 12

c. Discuss the Genetic Implications of the Sandstone Composition 5

Q. 5.

a. Briefly discuss the Basaltic Andesitic and Rhyolitic magma 12

a. Discuss the color variation in mud rocks. 6

b. Briefly discuss the Ocean Floor Metamorphism 7

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Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Nuclear Geology
PAPER: IX / GEOL-211

TIME ALLOWED: 3 Hrs.
MAX. MARKS: 75

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

Q.1. Write down the physical and chemical properties of uranium

Q.2. What is meant by artificial radioactivity? Discuss uses of stable isotopes.

Q.3. What is carbon dating? Discuss its uses for dating of various materials.

Q.4. Explain K/Ar dating method in detail along with its applications and limitations.

Q.5. What is U-Pb dating technique? Discuss its principal and application in geology.

Q.6. Discuss the occurrence of uranium in pegmatites.

Q.7. Describe in detail the mode of occurrence of uranium in Pakistan.

Q. 8. What are Placer deposits? Discuss the prospects of uranium minerals in these deposits.

UNIVERSITY OF THE PUNJAB

Second Prof. A/2018

Examination:- B.S. Applied Geology

Roll No. .....

Subject: Structural/Petroleum Geology **TIME ALLOWED: 3 Hrs.**

PAPER: X / GEOL-212 **MAX. MARKS: 75**

NOTE: Attempt any THREE questions selecting ONE question from each Part. All questions carry equal marks.

Part-I

Q. 1 What are faults? Explain its components and types.

Q. 2 What are folds? Discuss Ramsey classification of folded layers.

Q. 3 Describe the followings:

a) What are synthetic and antithetic faults?

b) What are Horst and Graben structures?

c) What is role over anticline?

Part –II

Q. 4 What are hydrocarbon traps? Discuss different types of traps-

Q. 5 What is a reservoir rock? Define its physical properties.

Q. 6 Discuss kerogen and its types.

UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Mathematics II Paper: II / MATH-202 Time: 3 Hrs. Marks: 100

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

Q1. (a) Find the general solution of the differential equation (10)

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 4y = 8x - 10 - 10\cos 2x$$

(b) Show that $y = 2x + \sin 2x$ is a particular integral of the given differential equation. (10)

Q2. (a) Find the root of the following equation using Regula Falsi Method up to three decimal places correction. (10)

$$5x^3 - x + 3 = 0$$

(b) Using Newton Raphson Method, find the real root of the following equation (10)

$$x^3 + 10x^2 - 5 = 0$$

Q3.

X	2	4	5	6	8	10
f(X)	354	332	291	260	231	204

(a) Using Newton's forward interpolation method, estimate the value of $f(3)$ from the above data. (10)

(b) Using Newton's divided difference interpolation formula, find the value of $f(9)$ from the above data. (10)

Q4. Show that the function $u(x, y) = 2x + y + x^2 - y^2 - 2xy$ is harmonic anc determine the harmonic conjugate $v$which satisfies $v(0,0) = 1$ (20)

Q5. Find the scalar triple product and vector triple product of the following vectors. (20)

$$\vec{l} = \hat{\imath} + 5\hat{\jmath} - 73\hat{k}$$

$$\vec{m} = 75\hat{\imath} + \hat{\jmath} + 9\hat{k}$$

$$\vec{m} = -119\hat{\imath} - 10\hat{\jmath} + 21\hat{k}$$

Q6. Find a unit vector which makes an angle of 45° with $\vec{a} = [-3,\ 0,\ -1]$ and an angle of 60° with $\vec{b} = [10,\ 1,\ -1]$ (20)

Q7. (a) Calculate $L^{-1}\left\{\frac{1}{x^2+47x-5}\right\}$ (10)

(b) Verify the formula $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$ (10)

If

$$\vec{a} = \hat{\imath} - \hat{\jmath}$$

$$\vec{b} = -5\hat{\imath} + 2\hat{k}$$

$$\vec{c} = 9\hat{\jmath} + 9\hat{k}$$

UNIVERSITY OF THE PUNJAB

B.S. Applied Geology / Second Prof. 2nd Annual 2020

Subject: Physics II Paper: III / PHYS-203

Roll No. .....

Time: 3 Hrs. Marks: 75

NOTE: Attempt FIVE questions in all while Question 1 and 2 are compulsory.

Q.1) (*a*)Define any 6 of the following terms, $(2 \times 6 = 12)$

Thermometric property, Ideal gas law, Triple point, Convection, Geochronology, Half-lives, Resistance, Beta negative decay

(*b*) Write short answer of any 6 question, $(2 \times 6 = 12)$

(i) Differentiate between open and closed system?

(ii) Differentiate between isochoric and isobaric process?

(iii) Differentiate between work and heat?

(iv) Differentiate between red shift and blue shift?

(v) what is Radioactive decay? write the name of three major types of nuclear decay?

(vi) Calculate the threshold temperature of an electron?
$(m_e = 9.1 \times 10^{-31} kg, k = 1.38 \times 10^{-23} JK^{-1})$

(vii) Write down some properties of gravitational force?

(viii) Differentiate between destructive and non destructive site investigation techniques?

Q.2) **(a)** Differentiate between conservative and non-conservative force? Prove that pressure force is non-conservative? $(2+7)$

(b) A pair of eyeglass frames is made of epoxy plastic. At room temperature $20.0°C$, the frames have circular lens holes $2.20cm$ in radius. To what temperature must the frames be heated if lenses $2.21cm$ in radius are to be inserted in them? The average coefficient of linear expansion for epoxy is $1.30 \times 10^{-4}(°C^{-1})$? (3)

Q.3) **(a)** What is the Big Bang theory? Write down any three Observational evidence that support this theory, also describe them briefly? $(2+8)$

(b) Determine an estimate of the age of the universe using Hubble's law?
(H = 70 km/sec per Mpc, 1Mpc= 3.09×10^{19}km) (3)

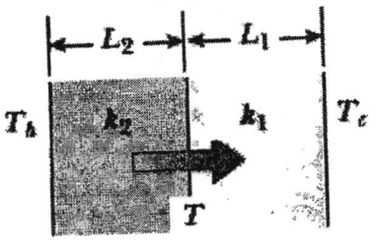
Q.4) **(a)** Date a meteorite which contains potassium knowing that its content of $^{40}\mathbf{K}$ is 1.19×10^{14}atoms g^{-1}, of $^{40}\mathbf{Ar}$ is $4.14 \times 10^{17} atoms\ g^{-1}$, and that the half-life of $^{40}\mathbf{K} \rightarrow {}^{40}\mathbf{Ar}$ is 1.19×10^9 year? (9)

(b) What is the binding energy of an α particle (a $^4_2\mathbf{H}$ nucleus)? Also find binding energy per nucleon? The needed masses are, $m_n = 1.008664u$, atomic masses of m(^{1}H)=1.00784u, and m(^{4}H)=4.002602u (4)

Q.5) What is stellar evolution? Describe the life cycle of low mass star? (13)

P.T.O.

Q.6) (a) The temperature of a silver bar rises by $10.0°C$ when it absorbs $1.23kJ$ of energy by heat. The mass of the bar is $525g$. Determine the specific heat of silver. (3)
(b) State Fourier law of heat conduction? Two slabs of thickness L_1 and L_2 and thermal conductivities k_1 and k_2 are in thermal contact with each other, as shown in Figure The temperatures of their outer surfaces are T_c and T_h , respectively and $T_h > T_c$. Determine the temperature at the interface and the rate of energy transfer by conduction through the slabs in the steady-state condition. (2 + 8)



Q.7) (a) Define alpha decay. Find out the expression of disintegration energy using conservation of energy? (2+4)
(b) Find the energy released during the alpha decay of $^{238}\mathbf{U}$. Show that this nuclide cannot spontaneously emit a proton? The needed atomic masses are m($^{238}\mathbf{U}$)= 238.05079u, m($^{234}\mathbf{Th}$)= 234.04363u, m($^{4}\mathbf{He}$)= 4.00260u, m($^{1}\mathbf{H}$)=1.00784u, m($^{237}\mathbf{Pa}$)=237.051143u. (3+4)

Q.8) (a) Write a note on Piezoelectricity and Its Applications. (10)
(b) Calculate the disintegration energy in the beta decay $^{32}\mathbf{P}$ of as described by

$$^{32}\mathbf{P} \longrightarrow {}^{32}\mathbf{S} + e^{-1} + \overline{\nu}$$

The needed atomic masses are 31.973907 u for $^{32}\mathbf{P}$ and 31.972071u for $^{32}\mathbf{S}$ (3)

Q.9) What is geophysical exploration? What are its common applications? Describe the Classification of geophysical techniques? (2+3+8)

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Chemistry II | Paper: IV / CHEM-203 | Time: 3 Hrs. Marks: 75

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

1	What is 2nd law of thermodynamics? Define Entropy and explain entropy change in reversible and irreversible processes	15
2	a) What are the applications of AAS,AES, and UV-Visible Spectroscopy b) How the properties of alpha, beta and gamma radiations differ from each others?	9 6
3	a) What is the principle of Atomic Absorption Spectroscopy? Draw the block diagram and explain the working of Monochromator. b) What type of analysis can be done of a geological sample with the help of Flame photometer or plasma spectroscopy?	10 5
4	c) What is the source of light in Atomic Emission Spectroscopy? Explain it. d) Explain the types of nuclear reactions occurring naturally.	7 8
5	a) Explain the working of PMT with reference to detectors. b) Define Nitrogen rule, molecular ion peak, base peak, isotopic peak and metastable ion peak with reference to MS	5 10
6	a) What is the principle of chromatography and how they can be classified? b) How age of Sulphide ore is determined? c) How radioactivity can be detected by Geiger Muller counter or photographic method? also give its unit?	6 6 3
7	a) Explain the principle and working of UV-Visible Spectrophotometer along with its applications. b) What is plasma emission spectroscopy?	10 5
8	a) Explain the thermodynamics and formation of Galena, Wollastonite and Malachite b) How law of mass action can be applied on any system c) What is the use of radioisotopes in geological analysis?	6 4 5

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Stratigraphy of Pakistan **Paper: V / GEOL-209** **Time: 3 Hrs. Marks: 75**

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

Q.1. Explain the Paleozoic system of Salt Range?

Q.2. Explain the Paleocene system of Pakistan?

Q.3. Write note on the followings?

i). Datta Formation
ii). Dhok Pathan Formation
iii). Mianwali Formation

Q.4. Explain the different branches of Stratigraphy? Explain the lithostratigraphy and Biostratigraphy in detail?

Q.5. Describe the Stratigraphy of Khewra Gorge in detail?

Q.6. Write detail note on Siwaliks of Pakistan?

Q.7. What are Sedimentary Basins and their different types?

Q.8. Briefly explain the followings:

i). Margalla Hill Limestone
ii). Nammal Formation
iii). Ghazij Formation

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Computing & Geostatistics Paper: VI / COMP-201 Time: 3 Hrs. Marks: 50

NOTE: Attempt any FIVE questions. All questions carry equal marks. Make a neat and clear diagram where necessary.

1	What is meant by computer database? Explain how the data is stored a database.	10
2	Describe different types of geological data commonly analyzed in the Earth sciences. Give examples to explain each type.	10
3	a. Explain different types of storages (memory) in a computer.	5
	b. Explain the following statistical approaches used to explain the geological data: I. Univariate analysis method II. Bivariate analysis method	5
4	Explain histograms and measure of central tendency, dispersion and shape of empirical data distribution utilized to explain the data set	10
5	Explain the following terms: I. Webpage II. Client III. Server IV. Domain V. IP	10
6	Describe the Pearson's Correlation Coefficient which is used to explain the geological data.	10
7	Explain why the linear regression analysis is performed to describe geological information.	10

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Survey & Mapping Techniques Paper: VII / SURV-201 Time: 3 Hrs. Marks: 50

NOTE: Attempt any FIVE questions.

Q. 1. Shortly explain that how total station is helpful for contouring purposes.

Q. 2. Explain in detail different drilling methods and in situ testing.

Q. 3. Write down the Compressive note on Plane Table method.

Q. 4. How logging is helpful is mapping and which types of geophysical logs are used in subsurface water assessment?

Q. 5. Briefly explain the correlation and various criteria of correlation narrating examples from Pakistan.

Q. 6. Which are the necessary elements in making a good quality map and how use locates you in the field on a map? Also explain the classification of the maps.

Q. 7. Explain with the help of diagram

I) Outcrop II) Profile III) Cross-section IV) Sucession V) Horizontal equivalent VI) Hill VII) Ridge VIII) Re-entrant IX) knoll X) water fall

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Petrology Paper: VIII / GEOL-210 Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. Be brief and to the point and draw the sketches where needed.

Q. 1.

a. Discuss the sequence of crystallization of minerals in the discontinuous branch of the Bowen Reaction series. 10

b. Discuss the evolution of Calc-alkaline and tholeiitic magma with the help of Ternary diagram 8

c. What is the significance of deviatoric stress in metamorphism? 7

Q. 2.

a. Classify the Ultramafic Igneous rocks upon the base of their modal mineralogy. 9

b. Discuss the pressure and temperature variations in common metamorphic facies. 8

c. Briefly discuss the genesis and Classification of Pyroclastic Rocks. 8

Q. 3.

a. Discuss the two component phase diagram when there is complete solid solution between the end members 10

b. Discuss the various types of components which constitute the Carbonate Rocks 10

c. Briefly discuss the Retrograde Metamorphism 5

Q. 4.

a. Discuss the terms which describe the parting in sandstones and shales 7

b. Describe the ophiolite as source of information about the oceanic crust. 12

c. Briefly discuss the Mud rocks6

Q. 5.

a. Discuss the textures: (i) Ophitic (ii) Amygdular (iii) Myrmekitic (iv) Orbicular (v) Gneissic 15

b. Discuss the diagenetic cycle in calcium sulfate minerals. 5

c. Explain how geothermometers and geobarometers work. 5

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B.S. Applied Geology / Second Prof. 2nd Annual 2020

Roll No. .....

Subject: Nuclear Geology Paper: IX / GEOL-211 Time: 3 Hrs. Marks: 75

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

Q.1. Write a note on Placer deposits? Discuss the prospects of uranium minerals in these deposits.

Q.2. What is carbon dating? Discuss its uses for dating of various materials.

Q.3. Write down the physical and chemical properties of uranium

Q.4. Explain K/Ar dating method in detail along with its applications and limitations.

Q.5. Discuss U-Pb dating technique in detail along with its principal and application in geology.

Q.6. What is meant by artificial radioactivity? Discuss uses of stable isotopes.

Q.7. Discuss the occurrence of uranium in pegmatites.

Q.8. Describe in detail the mode of occurrence of uranium in Pakistan.

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

Roll No. .....

Subject: Stratigraphy of Pakistan | Paper: V / GEOL-209 | Time: 3 Hrs. Marks: 75

NOTE: Attempt any FIVE questions. All questions carry equal marks. Draw figure where necessary.

Q.1. Explain the geological formations of Permian system of Pakistan in tabular form?

Q.2. What are Siwaliks of Pakistan? Write down its geological formations?

Q.3. Briefly explain the followings?

i). Lockhart Limestone
ii). Chinji Formation
iii). Mianwali Formation

Q.4. Briefly explain the followings?

i). Hangu Formation
ii). Chiddru Formation
iii). Nammal Formation

Q.5. What are the different branches of Stratigraphy? Explain any three types in detail?

Q.6. Explain the Geological time scale in tabular form?

Q.7. What are Sedimentary Basins? Explain their different types?

Q.8. Describe the Khewra Gorge in detail?

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

Roll No. .....

Subject: Petrology Paper: VIII / GEOL-210 Time: 3 Hrs. Marks: 75

NOTE: Attempt any THREE questions. Be brief and to the point and draw the sketches where needed.

Q. 1.

a. Discuss the order of crystallization of minerals from mafic magma 10

b. Discuss the main magma series in detail 8

c. Discuss the deviatoric pressure in metamorphism. 7

Q. 2.

a. Discuss the Modal Mineralogical Classification of Mafic Rocks. 9

b. Draw and explain the P-T diagram for common metamorphic facies. 8

c. Illustrate the Classification of Pyroclastic Rocks upon the base of Particle size. 8

Q. 3.

a. Discuss two component phase diagram w.r.t Fayalite and Forsterite 10

b. Discuss the Dunham Classification of the Carbonate Rocks. 10

c. Differentiate between the Prograde and Retrograde Metamorphism 5

Q. 4.

a. Discuss the Dott's Classification Scheme for Sandstones 7

b. What is an ophiolite? Describe its composition, structure, and origin. 12

c. Discuss the mineralogy of Mud rocks 6

Q. 5.

a. Discuss the textures: (i) Phaneritic (ii) Porphyritic (iii) Myrmekitic (iv) Poikilitic (v) Perthitic 15

b. Discuss the diagenesis of evaporites. 5

c. What are paired metamorphic belts? 5

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

Roll No. .....

Subject: Computing & Geostatistics **Paper: VI / COMP-201** **Time: 3 Hrs. Marks: 50**

NOTE: Attempt any FIVE questions. All questions carry equal marks. Make a neat and clear diagram where necessary.

1	a. What are computers? Describe the basic functions and components of a computer.	5
	b. Distinguish between univariate and bivariate data analysis methods with examples.	5
2	Describe different types of geological data (information) commonly analyzed in the Earth sciences. Provide examples to explain each type.	10
3	a. Explain the input and output computer peripherals.	5
	b. Explain the following statistical approaches used to explain the geological data: I. Signal processing II. Spatial data analysis	5
4	Explain the following terms: I. Network II. Internet III. Client IV. Webpages V. Web application	10
5	What are computer viruses? Explain the various types of computer viruses.	10
6	Explain characteristics of relational, object-oriented, and multidimensional databases.	10
7	What are histograms? Explain the quantitative measures used to explain the data set.	10

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

Roll No. .....

Subject: Mathematics II Paper: II / MATH-202 Time: 3 Hrs. Marks: 100

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

Q1. (a) Find the root of the equation $x^3 - x - 1 = 0$ using Bisection Method correct to three decimal places. (10)

(b) Find the particular solution of $y''-4y'+4y=(x+1)e^{2x}$ (10)

Q2. (a) Find the general solution of the differential equation $(D^2+3D+2)y=4x^2$ using the method of undetermined coefficients. (10)

(b) Estimate the value of $f(42)$ from the following data

X	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

using Newton's interpolation formulae. (10)

Q3. (a) Find the directional derivative of $\varphi = x^2yz+4xz^2$ at point $(1,-2,-1)$ in the direction $2\mathbf{i}-\mathbf{j}-2\mathbf{k}$. (10)

(b) Establish the Secant method formula for finding the square root of a real number R from the equation $x^2 - R = 0$. (10)

Q4. (a) Find the general solution of nonhomogeneous differential equation $y''+y=\tan x$. (10)

(b) Find the modulus of $\left(\frac{2+3i}{-2+i}\right)^2$. (10)

Q5. (a) Verify that the real and imaginary parts of $f(z)=z^2+5iz+3-i$ satisfy the Cauchy –Riemann equations. (10)

(b) Using Gauss's forward interpolation formula, find the value of **log 337.5** from the following table (10)

x	310	320	330	340	350	360
$y=\log x$	2.4914	2.5051	2.5185	2.5315	2.5441	2.5563

Q6. (a) Solve the differential equation $y''+y=4x+10\sin x$ subject to initial conditions $y(\pi)=0,\ y'(\pi)=2$. (10)

(b) Find the constant a so that the vector $\mathbf{V}=(x+3y)\mathbf{i}+(y-2z)\mathbf{j}+(x+az)\mathbf{k}$ is solenoidal (10)

Q7. (a) Find the third approximation using Newton Raphson method to approximate the value of $\sqrt[3]{2}$. (10)

(b)) Show that $f(z)=\frac{\cos\theta}{r}-i\frac{\sin\theta}{r}$ is analytic. Also find derivative of $f(z)$. (10)

Q8. (a) Find the derivative of $w=f(z)=\frac{2z-i}{z+2i}$ at $z=-i$. (10)

(b) Find the value of $f(3)$ from the following data

X	2	4	5	6	8	11
$f(x)$	35	33	29	26	23	20

using Newton's divided difference interpolation formula. (10)

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

Roll No. .....

Subject: Chemistry II | Paper: IV / CHEM-203 | Time: 3 Hrs. Marks: 75

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

1	What is 2nd law of thermodynamics? Define Entropy and explain entropy change in reversible and irreversible processes	15
2	a) What types of stationary phases are used in GC? b) What types of transitions are encountered in molecule? c) Differentiate between atomic and molecular spectroscopy?	5 5 5
3	a) What is the principle of Atomic Absorption Spectroscopy? Draw the block diagram and explain the working of Monochromator. b) Discuss the principle of Gas Chromatography	10 5
4	a) What is radioactivity? What are its units for measurement? Discuss their main Characteristics. b) Discuss the Principle of Mass Spectrometry and explain the working of Ionization Chamber.	8 7
5	a) What is the function of Flame in Atomic Emission Spectroscopy? Explain it. b) Give the applications of radioisotopes in geological analysis and daily life.	7 8
6	a) What is Beers Lambert Law? Derive and Expression for it. b) Differentiate between I. Chromophore and auxochrome II. Bathochromic effect and hyperchromic effect III. Transmittance and Absorbance IV. Lamda max and molar absorbtivity	7 8
7	a) Define the following terms: I. Molecular ion peak II. Base peak III. Isotopic peaks IV. Metastable ion peak V. Line Spectrum b) Explain method for detection and measurement of radioactivity	5 10
8	a) What is the function of column and explain different types of column used in Gas Chromatography. b) What is Nitrogen rule ? c) Arrange EMR in Increasing order of Frequency	10 3 2

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

Roll No. .....

Subject: Physics II | Paper: III / PHYS-203 | Time: 3 Hrs. Marks: 75

NOTE: Attempt FIVE questions.

Q#01 4+4+7

(a) Describe briefly Extensive and Intensive properties.

(b) Differentiate between active and passive geophysical methods.

(c) Write down the expressions for $\beta^+ decay$ and $\beta^- decay$ phenomenon.

Q#02 5+6+4

(a) Describe the second law of thermodynamics by different statements.

(b)What is heat engine? Describe the ideal heat engine.

(c) Describe the effect on internal energy during adiabatic expansion and compression.

Q#03 9+6

(a) What is thermal expansion? Derive a relationship between linear and volumetric expansion coefficients.

(b)A New River George Bridge 518m in length. How much does its length change between temperature extremes of -20°C and 53°C?

Q#04 9+6

(a)Describe the $\alpha - decay$ process and emission of α particle theory with tunneling.

(b) Calculate the energy released during the alpha decay of ^{238}U. The atomic masses are: m(^{238}U)= $238.05079u$, $m(^{234}Th) = 234.04363u$, $m(^{4}He) = 4.00260u$

Q#05 9+6

(a) What is half life and mean life time? Derive the relationship for half life time.

(b) Describe the phenomenon of electron capturing.

Q#06 7+8

(a) Write a note on Ferroelectricity and its applications.

(b) Describe the timeline and major events since Big Bang.

Q#07 5+10

What is Stellar evolution? Describe the life cycle of high mass star.

Q#08 5+5+5

(a) Write down some properties of electromagnetic force.

(b) Derive an expression for acceleration of gravity by using the law of Universal Gravitation and Newton,s second Law.

(c) What is Gravity method and also write down its applications.