

**PUNYASHLOK AHILYADEVJI HOLKAR  
SOLAPUR UNIVERSITY, SOLAPUR**



NAAC Accredited-2015  
'B' Grade (CGPA 2.62)

**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: GEO-CHEMISTRY**

**Name of the Course: B.Sc. II (Sem-III & IV)**

**(Syllabus to be implemented from w.e.f. June 2020)**

## **1) Preamble:**

Syllabus for B.Sc. II Geochemistry is designed to provide an insight of applications and concepts of basics geochemistry, its principles, physicochemical properties of minerals, solar system and dynamics of various spheres of the earth and chemistry of the earth. In the theory course student can acquire the knowledge about the chemical and atomic properties of mineral matter, integrated study of solar and earth system. Also emphasis has been given on the chemical properties and pollutions of spheres of the earth. The chemical process operating on the earth surfaces as well as chemical reactions, origin of various economic minerals has also included in the syllabus.

Practical course has been designed on the basis of theoretical approach and objectives of the course.

## **2) Objectives of the Course**

1. To introduce students to applications of chemical concepts to predict the outcome of geologic processes and use of chemical data to solve applied, real-world problems;
2. To introduce students to basic concepts of geochemistry and several up-to-date issues which are widely discussed in the field of geochemistry;
3. To orient students to the current status of numerous chemical analysis techniques commonly used in the field of geochemistry;
4. To provide students with opportunities to use available analytical instruments in the department;
5. To provide students with opportunity to discuss about their research topics in terms of geochemistry.
6. Understanding the basic principles of isotope geochemistry and to apply the fundamental principles to earth scientific processes.

## **3) Outcome of the Course**

1. Understand geochemical concepts operating within various spheres in the dynamic earth system.
2. Chemical analysis various ore minerals and its applications to mining industries.
3. Analysis of various pollutants in various ecosystems.
4. Increase in the curiosity about events in the universe and its origin.

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

**Faculty of Science & Technology  
Choice Based Credit System (CBCS)**

(w.e.f.2020-21)

**Draft Structure for B. Sc-II**

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks/ Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class:	B.Sc.- II Semester - III									
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject <b>OR</b>	C-5	Paper-V	3.0	--	--	50	40	10	4.0	
		Paper-VI	3.0	--	--	50	40	10		
	C-6	Paper-V	3.0	--	--	50	40	10	4.0	
		Paper-VI	3.0	--	--	50	40	10		
	C-7 <b>GEOCHEMISTRY</b>	<b>Paper-I Introduction to Geochemistry</b>	3.0	--	--	50	40	10	4.0	
			3.0	--	--	50	40	10		
	SEC-1									
	GE-3									
<b>Grand Total</b>				<b>18</b>	<b>--</b>	<b>--</b>	<b>300</b>	<b>240</b>	<b>60</b>	<b>12</b>
Class :	B.Sc.- II Semester - IV									
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject <b>OR</b> Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be the Core Subject and any One Subject among the other will be Elective Subject	C-8	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper-VIII	3.0	--	--	50	40	10		
	C-9	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper-VIII	3.0	--	--	50	40	10		
	C-10 <b>GEOCHEMISTRY</b>	<b>Paper-III Principles of Geochemistry</b>	3.0	--	--	50	40	10	4.0	
			3.0			50	40	10		
	SEC-2									
	GE-4									
	Environmental Studies		3.0	--	--	50	40	10	NC	
<b>Total (Theory)</b>				<b>21</b>	<b>--</b>	<b>--</b>	<b>350</b>	<b>280</b>	<b>70</b>	<b>12</b>
Practical	C-5 & C-8	Pr. III&IV	--	--	8	100	80	20	4.0	
	C-6 & C-9	Pr. III&IV	--	--	8	100	80	20	4.0	
	C-7 & C-10	Pr. III&IV <b>Geochemistry</b>	--	--	8	100	80	20	4.0	
	GE-3 & GE-4									
<b>Total (Practical)</b>						<b>24</b>	<b>300</b>	<b>240</b>	<b>60</b>	<b>12</b>
<b>Grand Total</b>				<b>39</b>		<b>24</b>	<b>950</b>	<b>760</b>	<b>190</b>	<b>36</b>

**\*Core Subjects:**

**Chemistry / Physics / Electronics / Computer Science / Mathematics / Statistics / Botany / Zoology / Microbiology / Geology / Geography / Psychology  
Core Subjects- (Additional)-Geochemistry / Biochemistry / Meteorology / Plant Protection**

## Summary of the Structure of B.Sc. Programme

Class	Semester	Marks- Theory	Credits- Theory	Marks- Practical	Credits- Practicals	Total - credits
<b>B.Sc.-II</b>	III	300	12	--	--	12
	IV	350	12	--	--	12
<b>Total</b>		650	24	300	12	36

### **B.Sc. Programme:**

**Total Marks:** Theory + Practical's = 650 + 300 = 950

**Credits:** Theory + Practical's = 12 + 24 = 36

**Number of Papers**

Theory: Ability Enhancement Course (AECC)	: 00
Theory: Discipline Specific Elective Paper (DSE)	: 00
Theory: CC	: 06
Skill Enhancement Courses	: 00
GE	: 00

Total: Theory Papers : 06

Practical Papers : 02

### Abbreviations :

L:	Lectures
T:	Tutorials
P:	Practicals
UA:	University Assessment
CA:	College Assessment
DSC / CC:	Core Course
AEC:	Ability Enhancement Course
DSE:	Discipline Specific Elective Paper
SEC:	Skill Enhancement Course
GE:	Generic Elective
CA:	Continuous Assessment
ESE:	End Semester Examination

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**  
CBCS Pattern Syllabus of B. Sc. (Part-II), (w. e. f. June 2020)

**Geo-chemistry**  
**DSC/CC – Theory course**  
**SEMESTER – III**

Title of the Paper – **I. Introduction to Geochemistry**

Contact hours – 30

Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

<b>Unit</b>	<b>Topic</b>	<b>Contact Hrs</b>
<b>Unit 1</b>	Gibbs phase rule, one component system (water and sulphur), Goldschmidt's Mineralogical phase rule	(07)
<b>Unit 2</b>	The states of matter, the crystalline state, principles of crystal structure, formation of crystal, lattice energy of crystals, radius ratio, coordination number, structure of Sodium Chloride, Cesium Chloride, Zinc Sulphide. Brief idea of radii of common ions in rock forming minerals. General rules of the three dimensional structure with the help of solid geometry	(09)
<b>Unit 3</b>	Chemistry of carbon compounds, General characteristics of organic compounds, classification of organic compounds, homologous series, empirical and molecular formula of organic compound.	(07)
<b>Unit 4</b>	Colloids-Definition, electrical, mechanical and optical properties of colloids, origin of charge, kinds of colloidal system, silica as chemical sediment, clay minerals as colloids	(07)

**Reference Books:**

1. Brian Mason and C.B. Moore - Principles of Geochemistry
2. H.H. Read (ed.) - Rutley's Elements of Mineralogy
3. Krauskopf - Introduction to Geochemistry
4. Rollinson, H.R., 1993. Using geochemical data: Evaluation, Presentation, and Interpretation. Longman.

Title of the Paper – **II. Introduction to solar system and Geo-spheres**

Contact hours – 30

Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

<b>Unit</b>	<b>Topic</b>	<b>Contact Hrs</b>
<b>Unit 1</b>	Nature of solar system, composition of the sun; Composition of Meteorites and their types; Cosmic abundance of the elements	(08)
<b>Unit 2</b>	Zonal structure of the earth, Composition of the crust; Composition of the earth as a whole; primary differentiation of the elements, geochemical classification of the elements.	(08)
<b>Unit 3</b>	Structure of atmosphere, composition of the atmosphere, variable constituents of the atmosphere; Evolution of the atmosphere and composition of the primeval atmosphere; Atmospheric additions and losses during geological time	(07)
<b>Unit 4</b>	Nature of the hydrosphere, composition of seawater, composition of terrestrial waters; Gains and losses of elements in the oceanic water	(07)

**Reference Books:**

1. Brian Mason and C.B. Moore - Principles of Geochemistry
2. Krauskopf - Introduction to Geochemistry
3. Standard Manuals - Procedures for analysis and estimations of ores, minerals & rocks

**DSC/CC – Theory course**  
**SEMESTER – IV**

Title of the Paper – **III. Principles of Geochemistry**

Contact hours – 30

Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

<b>Unit</b>	<b>Topic</b>	<b>Contact Hrs</b>
<b>Unit 1</b>	Chemical equilibrium - The law of mass action, an example of equilibrium, hydrogen chloride, the effect of temperature, other examples as CO <sub>2</sub> in water and calcium sulphate. Le chatelier's rule, stability, Van't Hoff isotherm equation	(09)
<b>Unit 2</b>	Acids and bases, Chemical definition, Geological usage, pH, Hydrolysis of Na <sub>2</sub> CO <sub>3</sub> ; Estimation of ionic concentration, carbonate equilibrium, Temperature changes; Changes in pressure & organic activity	(08)
<b>Unit 3</b>	Organic material in sediments; organic reactions, carbon in rocks, origin of petroleum, origin of coal, organic matter in black shale, carbon compounds as reducing agents	(07)
<b>Unit 4</b>	Water pollution: types of water pollution, treatment on water pollutant by chemical oxygen demand (COD), biological oxygen demand (BOD) and Total dissolved solid (TDS)	(06)

**Reference Books:**

1. Brian Mason and C.B. Moore - Principles of Geochemistry
2. Krauskopf - Introduction to Geochemistry
3. Kula C. Misra. 2012. Introduction to Geochemistry: Principles and Applications. Wiley and Blackwell
4. Rollinson, H.R., 1993. Using geochemical data: Evaluation, Presentation, and Interpretation. Longman.

Title of the Paper – **IV. Chemistry of the Earth**

Contact hours – 30

Total Marks 50 (UA – 40 + CA – 10) (Credit 2)

<b>Unit</b>	<b>Topic</b>	<b>Contact Hrs</b>
<b>Unit 1</b>	The earth as a physico-chemical system; Crust as a separate system Geochemical cycle Fundamentals of Radioactive and Radiogenic Isotope Geochemistry. Geochronology: long-lived radioactive decay systems. Radiogenic Isotopic tracers: evolution of Mantle, Crust and Sediments.	12
<b>Unit 2</b>	Oxidation potentials- Oxidation and reduction, electrode reactions, standard potentials, use of the table of oxidation potentials; Redox potential, Ionic potential, Hydrogen ion concentration, Limits of pH and Eh in nature, Eh and pH diagrams.	07
<b>Unit 3</b>	Formation of clay minerals, their classification, types, composition. Properties of soils	04
<b>Unit 4</b>	Nature of chemical weathering, types- solution, hydration, Oxidation and hydrolysis. Agents of chemical weathering, Sequence of mineral alteration	04
<b>Unit 5</b>	Environmental pollution: Definition of pollution, Brief introduction types and sources of Air, Water and Soil Pollutions	03

**Reference Books:**

1. Brian Mason and C.B. Moore - Principles of Geochemistry
2. Khopkar S.M. - Environmental Pollution Analysis
3. K.S. Valdiya - Environmental Geology (Indian context)
4. Krauskopf - Introduction to Geochemistry
5. Standard Manuals - Procedures for analysis and estimations of ores, minerals and rocks



# Syllabus of B Sc. (Part-II) Geochemistry Laboratory Course

Marks – 80 + 20 = 100

Credit – 4

## Practical – I

- Section A** Volumetric analysis and chromatography experiments
- Estimation of alumina in ore, Estimation of manganese in ore, Estimation of calcium and magnesium in carbonate rocks. (5)
  - Analysis of natural waters and soils. Estimation of Ca, Mg-carbonates, bicarbonates, chlorides, and sulphates. (5)
  - Detection of traces of metals by chromatography. (5)
- Section B** Qualitative and Colorimetric Analysis
- Qualitative analysis of representative ores and minerals. (5)
  - Calorimetric determinations: (5)
    - a) Estimation of alumina    b) Estimation of manganese,
    - c) Estimation of total Iron    d) Estimation of copper

## Practical – II

- Section C** Mineral and Rock Calculations experiments
- Pyroxene- Hess calculation from given chemical data. (8)
  - Plagioclase- Feldspar calculations (6)
  - Norm calculations from given chemical data (Persalic type only) (8)
- Section D** Mineral identification
- Identification and description of following ores and industrial Minerals - Hematite, magnetite, pyrolusite, psilomelane, galena, graphite, chalcopyrite, malachite, chromite, bauxite, coal, muscovite, biotite, calcite, dolomite, garnet, quartz, olivine, tourmaline, talc, barytes, kyanite, asbestos, plagioclase, orthoclase, and gypsum. (3)

## Practical Record

- Certified record of the practical done by the student should be maintained as a journal and must be submitted at the time of annual practical examination.
- Certified report of Field visit / Project / Oral / Seminar / Group discussion should be submitted before annual practical examination.
- Demonstration of GM counter.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

## Syllabus for B.Sc. II- Geochemistry - (IDS)

### Semester System

### Choice Based Credit System (CBCS) Pattern

To be implemented from Academic Year- 2020 - 21

Course Structure –Total Credit 12 - (Theory (4 x 2) = 12+Practical (1 x 4) = 4)

Sr. No.	Semester	Paper No.	Title	No. of Contact Hrs/sem.	Credit Point	Total Marks (UA + CA)
1	Semester III	I	Introduction to Geochemistry	30	02	50 = 40+10
		II	Introduction to Solar system and Geo-spheres	30	02	50 = 40+10
2	Semester IV	III	Principles of Geochemistry	30	02	50 = 40+10
		IV	Chemistry of the Earth	30	02	50 = 40+10
3	Semester III and IV	Practical Course	Practical Examination (Two Days) (Annual Pattern)	60	04	100 = 80 + 20
				Total	12	300 = 240 +60

### IMPORTANT TO NOTE

- 40 marks for university examinations (UA) + 10 marks internal examinations (CA) = 50 marks
- Minimum passing percentage = 40%
- Separate passing for both university (UA) and internal examinations (CA) in Theory and Practical examinations

### 2. Distribution of each Theory paper (Marks 50)

University Assessment (UA) :40 Marks

College Assessment (CA) :10 Marks

### 3. Distribution of each Practical Marks (100)

Practical examination will be conducted annually i.e. at the end of fourth semester. It will be conducted for 80 marks (UA) and 20 marks (CA).

80 (UA) + 20 (CA) = 100 marks

#### University Practical Examination for 80 Marks (UA):

##### 1<sup>st</sup> day – Practical I

**Total-40 marks**

<b>Section A</b>	A1	Estimation	10 marks	Total 20
	A2	Chromatography	10 marks	
<b>Section B</b>	B1	Colorimetric	10 marks	Total 20
	B2	Qualitative analysis	10 marks	

##### 2<sup>st</sup> day – Practical II

**Total-40 marks**

<b>Section C</b>	C1.	Pyroxene (One example)	06 marks	Total 25
	C2.	Norm (One example)	12 marks	
	C3.	Feldspars (Two examples)	07 marks	
<b>Section D</b>	D1.	Identification of minerals	10 marks	Total 15
	D2.	Certified Journal submission	05 marks	

- **Theory internal continuous assessment (CA):**
- 5 marks - home assignment and 5 marks - unit test.
- Total 10 marks for each paper / semester
- **Practical internal continuous assessment (CA):**
- Practical exam of 10 marks covering topics of Paper I and II.
- Practical exam of 10 marks covering topics of Paper III and IV.
- Submission of report of eological Field excursion / project / Oral / Seminar / group discussion is compulsory.

## Equivalent Subject for Old Syllabus

<b>Sr. No.</b>	<b>Name of the Old Paper</b>	<b>Name of the New Paper</b>
1.	PI – Introduction to Geochemistry	PI – Introduction to Geochemistry
2.	PII – Introduction to Solar system and Geo-spheres	PII – Introduction to Solar system and Geo-spheres
3.	PIII – Principles of Geochemistry	PIII – Principles of Geochemistry
4.	PIV – Chemistry of the Earth	PIV – Chemistry of the Earth