

Solapur University, Solapur

Syllabus for B.Sc. II- Geology (Semester System)

To be implemented from Academic Year- 2014-15

Course Structure

Sr. No.	Semester	Paper No.	Title	No. of Lecture	Total Marks
1	Semester III	V	Optics and Mineralogy	45	50
		VI	Structural Geology	45	50
2	Semester IV	VII	Igneous Petrology	45	50
		VIII	Sedimentary and Metamorphic Petrology	45	50
3	At the end of IV Semester		Practical Examination (Annual Pattern)		100
				Total	300

Examination Question Paper Pattern:

Theory Question paper pattern- As per University Pattern

Practical Paper Pattern - As Given

Solapur University, Solapur

Syllabus for B.Sc. II - Geology

Semester System

To be implemented from Academic Year- 2014 -15

Theory

SEMESTER – III

Paper–V: - Optics and Mineralogy

(50 Marks)
(45 Periods)

Optics:

(15 periods)

Unit 1- Petrological Microscope, Behavior of light under petrological microscope
(5 Periods)

Unit 2- Study of the following optical properties –
Color, Form, Cleavage, Fracture, Inclusion, Alteration, Relief, Twinkling,
Pleochroism, Absorption, Isotropism , Anisotropism, Extinction- types of
extinction, extinction angle, Twinning, Zoning, Interference colors
(10 Periods)

Mineralogy:

(30 Periods)

Unit 3- Silicate structures (3 periods)

Unit 4- Isomorphism, Polymorphism, Pseudomorphism (3 periods)

Unit 5- Physical properties, optical properties, mode of occurrence, structure and
Chemistry of the following mineral groups:

Olivine- Forsterite, Fayalite

Pyroxene – Enstatite, Hypersthene, Diopside, Augite, Jaedite

Amphibole –Anthophyllite, Tremolite, Actinolite, Hornblende, Glaucophan

Mica – Muscovite, Biotite, Phlogopite, Lepidolite

Feldspar - Orthoclase, Microcline, Plagioclase

Silica- Minerals with crystalline, crypto-crystalline and amorphous silica

Alumino Silicates - Sillimanite, Andalusite, Kyanite

Carbonates - Calcite, Aragonite, Magnesite

Chlorite - Chlorite

Garnet - Common Garnet

Feldspathoid – Leucite , Nephelene

Clay minerals–Kaolinite

(24 periods)

Reference Books:

1. Introduction to Rock Forming Minerals - Deer, Howie and Zussman
2. Optical Mineralogy- Paul Kerr
3. Rutley's Elements of Mineralogy –H.H. Read

Paper –VI: - Structural Geology

**(50 Marks)
(45 Periods)**

Structural Geology:

Unit 1- Concept of rock deformation and tectonics, Dip, Strike, Outcrop, width of outcrop, Inliers, Outlier, Lineation and foliation	(10 periods)
Unit 2- Fold – Types, nomenclature, Criteria for their recognition in field	(10 periods)
Unit 3- Faults - Classification, recognition in field, effects on outcrops	(10 periods)
Unit 4- Unconformity - Types, recognition in field	(7 periods)
Unit 5- Joints - Types, geometric and genetic classification	(8 periods)

Reference Books:

1. Fundamentals of Structural Geology- N.W.Gokhale
2. Structural Geology - M.P. Billing

SEMESTER – IV

Paper-VII: -- Igneous Petrology

(50 Marks)
(45 Periods)

Igneous Petrology:

- Unit 1- Crystallization processes of uni component, binary and ternary magma compositions
Formation of glass and crystals (15 periods)
- Unit 2- Reaction relationships, Textures and Micro-structures (10 periods)
- Unit 3- Classification of Igneous rocks - based on
Mode of occurrence, mineralogy, chemistry-
Shand's and Tabular classification (10 periods)
- Unit 4- Processes of Differentiation, Assimilation and Xenolith formation in magma
(10 periods)

Paper-VIII: - Sedimentary and Metamorphic Petrology.

(50 Marks)
(45 Periods)

Sedimentary Petrology :

(20 Periods)

- Unit 1- Classification of Sedimentary rocks- based on mineralogical composition characters of
the Sediments (size, shape etc.) (6 periods)
- Unit 2- Description of sedimentary rock –
Rudaceous group, (Conglomerate, Breccia),
Arenaceous group, (Sandstones, Grit, Arkose, Greywacke)
Argillaceous group (Shales)
Calcareous group (Limestones, Dolomites)
Oxides-Hydroxides group (Laterite, Bauxite) (8 periods)
- Unit 3- Processes and environments of sedimentation (6 periods)

Metamorphic Petrology:

(25 Periods)

- Unit 1- Brief outline of characters of stard metamorphic facies
(Greenschist, Amphibolite, Granulite, Eclogite) (5 periods)
- Unit 2- Fabric of metamorphic rocks-
Classification of metamorphic rocks based on fabric –
Strongly foliated, weakly foliated non foliated. (7 periods)
- Unit 3- Description of metamorphic rock types -
Strongly foliated (Slate, Phyllite, Schists),
Weakly foliated (Mylonite, Gneisses, Migmatite),
Non foliated (Quartzite, Marble, Hornfelse, Argillite, Granulite) (8 periods)
- Unit 4- Introduction to Retrograde metamorphism, Polymetamorphism, Metasomatism,
Anatexis (5 periods)

Reference Books:

1. Fundamentals of Sedimentary rocks – N.W.Gokhale
2. Igneous and Metamorphic Petrology- Turner Verhoogen
3. Igneous and Metamorphic Petrology- Best M.G.
4. Igneous Petrology - Anthony Hall
5. Igneous Petrology -Mihir K. Bose
6. Introduction to Sedimentology - Sengupta S.
7. Metamorphic petrology - Turner
8. Petro genesis of Metamorphic Rocks- Winkler H.G.F.
9. Petrology of Metamorphic Rocks- Mason Roger
10. Principles of Petrology - G.W. Tyrrell
11. Sedimentary Rocks- Petijohn F.J.

Syllabus of B Sc. (Part-II) Geology Practical Course (Annual Pattern)

Practical - I

(Course for Paper-III)

Unit I- Optics and Mineralogy:

Optics

1) Study of petrological microscope

- i) Study of optical properties of minerals in polarized light
- ii) Study of optical properties of minerals between crossed Nichol prisms

2) Microscopic study of minerals

- 1) Quartz 2) Orthoclase 3) Microcline 4) Plagioclase 5) Muscovite 6) Biotite
- 7) Hornblende 8) Actinolite 9) Tremolite 10) Augite 11) Hypersthene 12) Olivine
- 13) Garnet 14) Staurolite 15) Calcite 16) Chlorite

Mineralogy

3) Megascopic Study of following minerals.

- 1) Silica Group-Quartz, Rock Crystal, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal
- 2) Feldspar Group- Orthoclase, Microcline, Plagioclase
- 3) Feldspathoid Group- Nepheline, Leucite, Sodalite
- 4) Mica Group- Muscovite, Biotite, Lepidolite, Phlogopite
- 5) Amphibole Group - Hornblende, Actinolite, Tremolite, Asbestos
- 6) Pyroxene Group - Augite, Diopside, Hypersthene
- 7) Olivine Group- Olivine
- 8) Epidote Group- Epidote
- 9) Chlorite Group – Chlorite
- 10) Garnet Group- Garnet
- 11) Alumino-Silicates- Kyanite, alusite, Sillimanite
- 12) Carbonate Group- Calcite, Dolomite, Magnesite
- 13) Zeolite Group- Natrolite, Stilbite
- 14) Apophyllite Group- Apophyllite
- 15) Corundum, Beryl, Staurolite, Tourmaline, Talc, Serpentine

Unit 2- Structural Geology:

1. Study of geological maps, drawing of geological sections of following types-
 - A) Horizontal Series
 - B) Inclined series
 - With intrusions - sill, vertical dyke, two intersecting vertical dykes
 - With vertical fault
 - C) An unconformity separating inclined series with horizontal series.
2. Study of structural problems -involving strike, true and apparent dip, width of outcrop by graphical method.

Unit 3 - Petrology

1) Megascopic Study of following rocks:

- A. **Igneous:** 1) Granite 2) Hornblende granite 3) Graphic granite 4) Syenite 5) Diorite
6) Gabbro 7) Dunite 8) Porphyritic granite 9) Pegmatite 10) Dolerite 11)
Rhyolite 12) Pitchstone 13) Obsidian 14) Pumice 15) Trachyte 16) Felsite
17) Basalt
- B. **Sedimentary:** 1) Sandstone 2) Ferruginous sandstone 3) Arkose 4) Breccia
6) Conglomerate 7) Limestone 8) Oolitic limestone 9) Fossiliferous
limestone 10) Shale 11) Laterite 12) Bauxite
- C. **Metamorphic:** 1) Slate 2) Phyllite 3) Mica schist 4) Marble 5) Hornblende Schist 6)
Mica-garnet Schist 7) Mica-Staurolite schist 8) Chlorite Schist 9) Tremolite
Schist 10) Granite Gneiss 11) Biotite Gneiss 12) Hornblende Gneiss 13)
Augen Gneiss 14) Amphibolite 15) Banded Iron Formation 16) Charnockite
17) Quartzite

2) Study of Textures and structures with conditions of formation:

- A. **Igneous:** 1) Granitic Texture 2) Porphyritic Texture 3) Intergrowth 4) Graphic
Texture 5) Glassy texture 6) Flow Structure 7) Vesicular 8) Amygdaloidal
Structure 9) Ropy Structure 10) Pillow Structure 11) Columnar Structure 12)
Xenolithic Structure
- B. **Sedimentary:** 1) Graded bedding 2) Current bedding 3) Lamination 4) Ripple
Marks 5) Mud cracks 6) Clastic structure 7) Oolitic 8) Pisolitic structure 9)
Stratification
- C. **Metamorphic:** 1) Slaty Cleavage 2) Schistose Structure 3) Granulose Structure
Gneissose Structure 5) Augen Structure 6) Bed Structure 7) Granular-
Granoblastic Structure

3) Microscopic Study of following rocks:

- A) **Igneous:** 1) Granite 2) Hornblende granite 3) Graphic granite 4) Syenite 5) Gabbro
6) Diorite 7) Dunite 8) Basalt 9) Trachyte 10) Rhyolite
- B) **Sedimentary:** 1) Sandstone 2) Ferruginous Sandstone 3) Arkose 4) Limestone
5) Oolitic Limestone 6) Fossiliferous Limestone
- C) **Metamorphic:** 1) Hornblende Schist 2) Chlorite Schist 3) Tremolite Schist 4) Mica
Schist 5) Mica Garnet Schist 6) Mica Staurolite Schist 7) Granite Gneiss 8) Biotite
Gneiss 9) Hornblende Gneiss 10) Charnockite 11) Quartzite 12) Marble

4) Study of Textures - Microstructures in Rocks with formation:

- A) **Igneous:** - 1) Granitic Texture 2) Ophitic Texture 3) Porphyritic Texture
4) Intergrowth 5) Graphic Texture 6) Intergranular Texture 7) Flow Structure 8)
Reaction Rim Structure

B) Sedimentary: - 1) Clastic Structure 2) Oolitic 3) Pisolitic Structure

C) Metamorphic: - 1) Slaty Cleavage 2) Schistose Structure 3) Granulose Structure
4) Gneissose Structure 5) Porphyroblastic

Unit 4 – Study Tour - Field Studies and Practical Record

1) Study tour - Field Studies:

Study tour in the areas of geological interest up to 7 days - long tour or short tours to nearby places to teach the students various rock types their field characters relations. Submission of field report field collection at the time of practical examination is necessary.

2) Practical Record:

Record of the practical done by the student should be maintained as a journal must be submitted at the time of annual practical examination

Annual Practical examination at the end of year (4th semester)

Practical Examination

Practical examination will be conducted annually i.e. at the end of fourth semester only.
It will be conducted for total 100 marks
on Two separate days for Two Practical (Each practical with 50 marks)

1st day – Practical I

Total - 50 marks

1) Mineralogy

Megascopic -	10 marks
Microscopic -	10 marks

2) Petrology

Megascopic – Igneous	06 marks
Microscopic – Igneous	04 marks
Megascopic – Sedimentary	06 marks
Microscopic – Sedimentary	04 marks
Megascopic – Metamorphic	06 marks
Microscopic – Metamorphic	04 marks

2nd day- Practical II

Total - 50 marks

1) Textures- Structures in rocks

Microscopic- Igneous, Sedimentary, Metamorphic (1 each)	06 marks
Megascopic - Igneous, Sedimentary, Metamorphic (3each)	09 marks

2) Structural Geology – Geological Map with Section Drawing 10 marks

3) Structural Problem- 05 marks

4) Certified Journal 10 marks

5) Tour Report with field collection. 10 marks

Solapur University, Solapur

Syllabus for B.Sc. II- Geochemistry (IDS) (Semester System)

To be implemented from Academic Year- 2014 -15

Course Structure

Sr. No.	Semester	Paper No.	Title	No. of Lecture	Total Marks
1	Semester III	I	Introduction to Geochemistry	45	50
		II	Introduction to Solar system and Geo-spheres	45	50
2	Semester IV	III	Principles of Geochemistry	45	50
		IV	Chemistry of the Earth	45	50
3	At the end of IV Semester		Practical Examination (Annual Pattern)		100
				Total	300

Examination Question Paper Pattern:

Theory Question paper pattern- As per University Pattern

Practical Paper Pattern - As Given

Solapur University, Solapur

(Interdisciplinary subject - IDS)

Syllabus of Geochemistry at B.Sc. II

To be implemented from **June 2014**

Theory

Semester -III

**Paper- I: Introduction to Geochemistry (50 Marks)
(45 Periods)**

- Unit 1- Gibbs phase rule, one component system (water and sulphur), Goldschmidt's mineralogical phase rule. (10 periods)
- Unit 2- 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, Caesium 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 (15 periods)
- Unit 3- Covalent bonds, general rules of bond type, electro negativity, atomic substitution (10 periods)
- Unit 4- Silicate structures, Isomorphism, Polymorphism (10 periods)

**Paper II- Introduction to solar system and Geo-spheres (50 Marks)
(45 Periods)**

- Unit 1- Nature of solar system, composition of the sun; Composition of Meteorites and their types; Cosmic abundance of the elements (10 periods)
- Unit 2- 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 (10 periods)
- Unit 3- 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 (15 periods)
- Unit 4- Nature of the hydrosphere, composition of seawater, composition of terrestrial waters; Gains and losses of elements in the oceanic water. (10 periods)

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 Standard Manuals - Procedures for analysis and estimations of ores, minerals & rocks

Semester- IV

Paper –III: Principles of Geochemistry

(50 Marks)
(45 Periods)

- Unit 1- Chemical equilibrium - The law of mass action, an example of equilibrium, hydrogen chloride, the effect of temperature, other examples as CO₂ in water and calcium sulphate. Le chatelier's rule, stability, conventions of chemical equilibrium (10 periods)
- Unit 2- Acids and bases, Chemical definition, Geologic usage, pH, Hydrolysis of Na₂CO₃; Estimating ionic concentration, carbonate equilibrium. Temperature changes; Changes in pressure & organic activity. (10 periods)
- Unit 3- Organic material in sediments; The chemistry of carbon compounds, organic reactions, carbon in rocks, origin of petroleum, origin of coal, organic matter in black shale, carbon compounds as reducing agents. (10 periods)
- Unit 4- Colloids- Definition, properties of colloids like electric charges, ion exchange and stability, kinds of colloidal system, silica as chemical sediment, clay minerals as colloids; Structure and properties of important clay minerals; Classification of clay minerals (15 periods)

Paper IV- Chemistry of the Earth

(50 Marks)
(45 Periods)

- Unit 1- The earth as a physico-chemical system; Crust as a separate system. Geochemical cycle (9 periods)
- Unit 2- 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. (9 periods)
- Unit 3- Formation of clay minerals- Formation, classification, types, composition and properties of soils (9 periods)
- Unit 4- Chemical Weathering - Nature, solution, hydration, oxidation and hydrolysis. Agents of chemical weathering, sequence of mineral alteration (9 periods)
- Unit 5- Environmental pollution: Definition of pollution, Brief introduction to Air, Water and Soil Pollutions (9 periods)

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.

Practical course (Annual pattern)

100 marks

Practical – I

Section A - Volumetric analysis and chromatography

- 1 Estimation of alumina in ore, Estimation of manganese in ore, Estimation of calcium and magnesium in carbonate rocks. (6 experiments)
- 2 Analysis of natural waters and soils. Estimation of Ca, Mg-carbonates, bicarbonates, chlorides, and sulphates. (5 experiments)
3. Detection of traces of metals by chromatography. (5 experiments)

Section –B - Qualitative and Colorimetric Analysis

- 4 Qualitative analysis of representative ores and minerals. (6 experiments)
- 5 Calorimetric determinations: (6 experiments)
 - 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:

- 1 Pyroxene- Hess calculation from given chemical data. (8 experiments)
- 2 Plagioclase- Feldspar calculations (8 experiments)
- 3 Norm calculations from given chemical data (Persalic type only) (8 experiments)

Section D – Mineral identification

Identification and description of following ores and industrial Minerals - (4 experiments)
Hematite, magnetite, pyrolusite, psilomelane, galena, graphite, chalcopyrite, malachite, chromite, bauxite, bituminous coal, anthracite coal, muscovite, biotite, calcite, dolomite, garnet, quartz, olivine, tourmaline, talc, barytes, kyanite, asbestos, plagioclase, orthoclase, and gypsum.

Annual Practical Examination

The entire practical examination will consist of total 100 marks.

Two separate examinations for Two days for

Section A and B - on first day (45 marks)

Section C and D - on second day (55 marks)

The distribution of marks for practical is as follows:

Section A	A1	Estimation	12 marks	Total 24
	A2	Chromatography	12 marks	
Section B	B1	Colorimetric	12 marks	Total 21
	B2	Qualitative analysis	09 marks	
Section C	1.	Pyroxene (One example)	11 marks	Total 35
	2.	Norm (One example)	12 marks	
	3.	Feldspars (Two examples)	12 marks	
Section D		Identification of minerals	10 marks	Total 20
		Certified Journal submission	10 marks	