

SOLAPUR UNIVERSITY, SOLAPUR



Faculty of Science

CBCS Pattern Syllabus

B.Sc.II (Sem-III and IV)

GEOLOGY (Paper V to VIII)

With effect from June-2017

1) Preamble:

Syllabus for B.Sc. II Geology is designed to allow students to develop a strong footing in the fundamentals and specialize in the geology as a career of his/her liking and abilities. Appraising the students perused basic concepts of geology in the B.Sc. I course, this course would have to develop in depth understanding of various aspects of the subject. The geological processes, physical, optical and atomic structures and experimental skills associated with different fields of Geology such as optical mineralogy, structural geology and igneous, sedimentary and metamorphic petrology etc..

Practical course has been designed on the basis of theoretical approach and objectives of the course. Also emphasis has been given on the optical characters of minerals, topographic maps and problems in structural geology.

2) Objectives of the Course

1. To study the silicate structures and formation of minerals with their physical, chemical and optical characteristics to understand the nature of geological framework with time and space and to review the potentiality of economic resources for exploration;
2. To introduce the fundamentals of structures and the underlying physical processes of rock deformation. Identification of geological structures and their features as well as criteria to recognize them in the field, their significance in geological setup, and exploration of geological resources;
3. To introduce the igneous processes, physical and chemical characteristics of magma, and various rock types. It describes occurrence and geological setting of igneous rocks;
4. To understand various metamorphic agents, processes, types and formation of metamorphic rocks. To introduce concept of their facies;
5. To study the sedimentation process, its physical and chemical characteristics to understand the sedimentary basin history to review its potentiality of the basin for economic resources exploration and to understand the geological framework with time and space;
6. To provide students with opportunity to use available analytical instruments and specimens in the department.

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Syllabus for B.Sc. II- Geology

Semester System

Choice Based Credit System (CBCS) Pattern

To be implemented from Academic Year- 2017 - 18

Course Structure –Total Credit 20 - (Theory (4 x 3) = 12+Practical (1 x 8) = 8)

Sr. No.	Semester	Paper No.	Title	No. of Lectures	Credit Point	Total Marks (UA + CA)
1	Semester III	V	Optics and Mineralogy	45	3	100 = 70+30
		VI	Structural Geology	45	3	100 = 70+30
2	Semester IV	VII	Igneous Petrology	45	3	100 = 70+30
		VIII	Sedimentary and Metamorphic Petrology	45	3	100 = 70+30
3	Semester III and IV	Practical Course	Practical Examination (Two Days)(Annual Pattern)		8	200 = 140 + 60
				Total	20	600 = 420 +180

IMPORTANT TO NOTE

- ✓ 70 marks for university examinations (UA) + 30 marks internal examinations (CA)
- ✓ Minimum passing percentage = 40%
- ✓ Separate passing for both university (UA) and internal examinations (CA) in Theory and Practicals

2. Distribution of each Theory paper (Marks 100)

University Assessment (UA) :70 Marks

College Assessment (CA) :30 Marks

3. Distribution of each Practical Marks (200)

Practical examination will be conducted annually i.e. at the end of fourth semester. It will be conducted for total 140 marks. Two separate days for Two Practicals (Each practical with 70 marks)

A. University Practical Examination for 140 Marks (UA):

1st day – Practical I

Total-70 marks

Section A	Optics and Mineralogy	30 marks	Total 30
	Microscopic and Megascopic study of minerals	15 marks 15 marks	
Section B	Geological maps, silicate structures and structural models	40 marks	Total 40
	1. Geological maps – section and description	20 Marks	
	2. Structural problem	10 Marks	
	3. Identification of silicate structures	05 Marks	
	4. Identification of structural models	05Marks	

2st day – Practical II

Total-70 marks

Section C	Microscopic Petrology and textures and structures of rocks	45 marks	Total 45
	1. Microscopic study of igneous, sedimentary and metamorphic rocks	20 marks	
	2. Microscopic study of textures and structures	25 marks	
Section D	Viva, journal and Field report	25 marks	Total 25
	1. Viva voce	10 Marks	
	2. Journal	05 Marks	
	3. Field report	15 marks	

B. Theory internal continuous assessment (CA):

1. 15 marks - home assignment and 15 marks - unit test.

Total 30 marks for each paper / semester

C. Practical internal continuous assessment (CA):

1. Practical exam of 30 marks covering topics from sections A and B.

2. Practical exam of 30 marks covering topics from sections C and D.

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B.Sc. II Geochemistry (CBCS Pattern) - IDS (Inter-Disciplinary Subject)

Theory

Semester -III

Paper- III: Optics and Mineralogy

Total Marks - 100 (UA-70+CA-30)

(70 Marks) (credit 3)

(45 Periods)

Unit 1 Optics: Study of petrological Microscope. Behaviour of light under (20 periods)

petrological microscope. Study of the following optical properties - Colour, form, cleavage, fracture, relief, pleochroism, absorption, twinkling, isotropism, anisotropism, extinction-types of extinction, extinction angle, twinning, zoning, inclusion, alteration, birefringence and interference colours.

Unit 2 Mineralogy: Silicate structures, Isomorphism, Polymorphism, (25 periods)

Pseudomorphism. Physical properties, optical properties, mode of occurrence, structure and chemistry of the following mineral groups:

1. Olivine- Forsterite, Fayalite, Olivine
2. Pyroxene – Enstatite, Hypersthene, Diopside, Augite, Jaedite
3. Amphibole – Tremolite, Actinolite, Hornblende, Glaucophane
4. Mica – Muscovite, Biotite, Phlogopite, Lepidolite
5. Feldspar - Orthoclase, Microcline, Plagioclase
6. Silica- Minerals in crystalline, crypto- crystalline and amorphous silica forms
7. Alumino Silicates - Sillimanite, Andalusite, Kyanite
8. Carbonates - Calcite, Aragonite, Magnesite
9. Chlorite - Chlorite
10. Garnet – Garnet and gem varieties
11. Felspathoid – Leucite, Nephelene
12. Clay mineral–Kaolinite

Reference Books:

1. Optical Mineralogy – Paul Kerr.
2. Rutley's Elements of Mineralogy - H.H. Read (ed.)
3. Introduction to rock forming minerals – Deer, Howai and Zussman

Paper IV–Structural Geology

Total Marks - 100 (UA-70+CA-30)
(70 Marks) (credit 3)
(45 Periods)

- Unit 1** Concept of rock deformation & tectonics. Dip, Strike, Outcrop, width of outcrop, Inliers, outlier, Lineation and foliation (10 periods)
- Unit 2**
1. Fold – Definition, nomenclature, types of folds, criteria for their recognition in field. (10 periods)
 2. Faults - Definition, nomenclature, classification, criteria for their recognition in field and effects on outcrops. (10 periods)
 3. Unconformity - Definition, nomenclature, types and criteria for their recognition in field. (07 periods)
 4. Joints - Definition, geometric and genetic classification. (08 periods)

Reference Books:

1. Fundamentals of structural geology – Gokhale N. W.
2. Structural geology- M.P. Billing

Semester- IV

Paper –V: Igneous Petrology

Total Marks - 100 (UA-70+CA-30)
(70 Marks) (credit 3)
(45 Periods)

- Unit 1 Definition of crystal and crystallization. Crystallization processes of unicomponent, binary and ternary magma compositions. Factors controlling crystallization processes. Formation of glass and crystals (15 periods)
- Unit 2
1. Reaction relationships. Textures and Micro-structures of igneous rocks (10 periods)
 2. Classification of Igneous rocks - based on mode of occurrence, mineralogy and chemistry – Shand's and tabular classification (10 periods)
 3. Processes of differentiation in magma, assimilation and Xenoliths formation (10 periods)

Reference Books:

1. Igneous and metamorphic Petrology - Best M.G
2. Igneous Petrology - Mihir K Bose
3. Igneous and Metamorphic Petrology- Turner Verhoogen
4. Igneous petrology - Anthony Hall
5. Principles of Petrology - G.W. Tyrrell

Paper VI- Sedimentary and Metamorphic Petrology

Total Marks - 100 (UA-70+CA-30)
(70 Marks) (credit 3)
(45 Periods)

- Unit 1 **Sedimentary Petrology:** (20 periods)
1. Classification of Sedimentary rocks based on – mineralogical and composition (siliciclastic, carbonate, evaporates, organic, Siliceous, iron-rich and phosphatic) and characters of the Sediments (size, shape) (06 periods)
 2. Description of sedimentary rock – Rudaceous group, (Conglomerate, Breccia), Arenaceous Group, (sandstones, grit, arkose, greywacke) Argillaceous group (shales, mudstone), Calcareous group (limestones, dolomites) Oxides-Hydroxides group (laterite, bauxite) (08 periods)
 3. Processes and environments of sedimentation. (06 periods)
- Unit 2 **Metamorphic Petrology:** (25 periods)
1. Definition of metamorphic rocks. Fabric of metamorphic rocks (05 periods)
 2. Classification of metamorphic rocks based on fabric - strongly foliated, weakly foliated and non- foliated. Description of metamorphic rock types- Strongly foliated (slate, phyllite, schists), Weakly foliated (mylonite, gneisses, migmatite), Non foliated (quartzite, marble, skarn, hornfelse, argillite, granulite) (10 periods)
 3. Brief outline of characters of important metamorphic facies (Greenschist, Amphibolite, Granulite Eclogite) (04 periods)
 4. Basics of Retrograde metamorphism, Polymetamorphism, Metasomatism and Anatexis (06 periods)

Reference Books:

Fundamentals of Sedimentary rocks – N.W.Gokhale
Igneous and metamorphic Petrology- Best M.G.
Igneous and Metamorphic Petrology- Turner Verhoogen
Introduction to Sedimentology - Sengupta S
Metamorphic petrology - Turner
Petrogenesis of Metamorphic Rocks- Winkler H.G.F

Petrology of Metamorphic Rocks - Mason Roger

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

Annual Pattern (CBCS)

Marks – 140 + 60 = 200
Credit – 8

Practical – I

- | | | |
|------------------|--|----------|
| Section A | Optics and Mineralogy | 30 Marks |
| 1. | Study of petrological microscope. | 15 Marks |
| | Study of optical properties of minerals in polarized light and between crossed nicol 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 | |
| 3. | 3) Megascopic Study of following minerals. | 15 Marks |
| | a. Silica Group – Quartz, Rock Crystal, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal | |
| | b. Feldspar Group– Orthoclase, Microcline, Plagioclase | |
| | c. Feldspathoid Group– Nepheline, Leucite, Sodalite | |
| | d. Mica Group– Muscovite, Biotite, Lepidolite, Phlogopite | |
| | e. Amphibole Group – Hornblende, Actinolite, Tremolite, Asbestos | |
| | f. Pyroxene Group – Augite, Diopside, Hypersthene | |
| | g. Olivine Group– Olivine | |
| | h. Epidote Group– Epidote | |
| | i. Chlorite Group – Chlorite | |
| | j. Garnet Group– Garnet | |
| | k. Alumino-Silicates– Kyanite, alusite, Sillimanite | |
| | l. Carbonate Group– Calcite, Dolomite, Magnesite | |
| | m. Zeolite Group– Natrolite, Stilbite | |
| | n. Apophyllite Group- Apophyllite | |
| | o. Corundum, Beryl, Staurolite, Tourmaline, Talc, Serpentine. | |

- Section B Geological maps, silicate structures and structural models** 40 Marks
1. Study of geological maps drawing of geological sections of following types 20 Marks
 - A) Horizontal Series
 - B) Inclined series: 1) With intrusions - sill, vertical dyke, two intersecting vertical dykes and 2) With vertical fault
 - C) An unconformity separating inclined series with younger horizontal series.
 2. Study of structural problems -involving strike, true apparent dips, width of outcrop by graphical method 10 Marks
 3. Identification and description silicate structure models, such as Neso, Soro, Cyclo, Ino (single), Ino (double), Phylo and Tectosilicates 05 Marks
 4. Identification, drawing and describing models of apparent dip and true dip, strike, outcrop, various types of fold, fault, unconformity and joint. 05 Marks

Practical – II

- Section C Microscopic Petrology and textures and structures of rocks** 45 Marks
1. **Microscopic Study of following rocks:** 20 Marks
 - 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 Stauroilite Schist, 7) Granite Gneiss, 8) Biotite Gneiss, 9) Hornblende Gneiss, 10) Charnockite, 11) Quartzite 12) Marble

2. **Study of Textures and Microstructures in Rocks with formation:** 25 Marks

A) Igneous rocks:

i) **Basic textures:** a) Crystallinity – holocrystalline, holohyaline and mero-hemicrystalline; b) Granularity – phaneritic, aphanitic, microcrystalline; c) shape of crystal – euhedral, anhedral and subhedral; d) Mutual relations – equigranular and inequigranular.

ii) **Equigranular textures:** 1) Granitic Texture, 2) Glassy

iii) **Inequigranular textures:** 1) Porphyritic 2) Poikilitic, 3) Ophitic 4) Intergranular 5) Trachytic or flow 6) Graphic Texture, 7) Reaction Rim Structure and 8) Expansion cracks

B) Sedimentary: 1) Clastic Structure, 2) Oolitic & Pisolitic Structure.

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

Section D Field Studies, Viva and journal 25 Marks

D

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 various rock types their field characters, formation, structures and relations. Submission of field report field collection at the time of practical examination is necessary. 15 Marks
2. **Viva Voce:** Viva based on practical and theory syllabus 5 Marks
3. **Certified 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. 10 marks

Equivalent Subject for Old Syllabus

Sr. No.	Name of the Old Paper	Name of the New Paper
1.	PIII – Optics Mineralogy	PIII – Optics Mineralogy
2.	PIV – Structural Geology	PIV – Structural Geology
3.	PV – Igneous Petrology	PV – Igneous Petrology
4.	PVI – Sedimentary & Metamorphic Petrology	PVI – Sedimentary & Metamorphic Petrology
5.	Practical course: Practical Examination (Annual Pattern) (Two days)	

Examination Structure- Nature of Question Paper

Theory examination

1. The Entire Theory examination will consists of **Four Papers;Two Papers in Each Semester**
2. **Each paper of 70 marks** - As per University common pattern for Science faculty

Time: 3hours

Annual Practical examination at the end of 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 140 marks

Two separate days for Two Practical (Each practical with 70 marks)

1st day – Practical I

Total-70 marks

Total-70 marks

Section A Optics and Mineralogy	30 marks	Total 30
Microscopic (5)	15 Marks	
Megascopic (15)	15 Marks	
Section B 1. Structural Geology – Geological Map with Section Drawing (1)	20 Marks	Total 40
2. Structural Problem (1)	10 Marks	
3. Identification of silicate structures (5)	05 Marks	
4. Identification of structural models (5)	05 Marks	

2nd day- Practical II

Total-70 marks

Section C Microscopic Petrology and textures and structures of rocks	45 Marks	
Petrology - Microscopic – Igneous (2),Sedimentary (2) Metamorphic (1)	20Marks	Total 45
Textures - Microscopic – Igneous (2),Sedimentary (2) Metamorphic (1)	25 marks	
Section D Viva, journal and Field report	25 marks	Total 25
1. Viva voce	10 marks	
2. Journal	05 Marks	
3. Field report	15 Marks	