

# Solapur University, Solapur

## Syllabus for B.Sc. III- Geology

### Semester System - CGPA

To be implemented from Academic Year- 2016 - 17

### Course Structure

{Total Credit 32- (Theory (8 x 3) = 24 +Practical (2x 4=8)}

Sr. No.	Semester	Paper No.	Title	Credit	No. of Lecture	Total Marks (External + Internal)
1	Semester V	IX	Earth's Physics and Dynamics	3	45	100 = 70+30
		X	Geomorphology	3	45	100 = 70+30
2	Semester V	XI	Environmental Geology	3	45	100 = 70+30
		XII	Hydrogeology and Remote Sensing	3	45	100 = 70+30
3	Semester VI	XIII	Crystallography, Principles of Stratigraphy and Earth's History	3	45	100 = 70+30
		XIV	Pre-Cambrian Stratigraphy of India	3	45	100 = 70+30
4	Semester VI	XV	Phanerozoic Stratigraphy of India	3	45	100 = 70+30
		XVI	Economic Geology	3	45	100 = 70+30
5	Semester V and VI		Practical Course I	4	120	200 = 140+60
			Practical Course II (Annual Pattern- Examination)	4	practical	200 = 140+60
					Total	1200 (840 UE + 360 I)

### IMPORTANT TO NOTE

- ❖ 70 marks for University exams + 30 marks Internal exams for each paper
- ❖ Separate passing in Theory and Practical – in both University and Internal examinations
- ❖ Minimum passing percentage = 40%

#### - Examination Structure -

- 1) The Entire Theory examination will consists of Eight Papers  
Four Papers in Each Semester with Each paper of 70 marks
- 2) Annual Practical examination of Two day's will consist of total 280 marks

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## Syllabus for B.Sc. III – Geology

### Semester System- CGPA

To be implemented from Academic Year- 2016 – 2017

#### Theory

#### Semester V

**Paper IX: Earth's Physics and Dynamics (100 Marks) (45 periods)**

Crustal movements: Orogenic and Epeirogenic movements	(8 periods)
Types of mountains and their origin – Volcanic, fold (Orogenic), Block and Denudational	(10 periods)
Isostasy	(7 periods)
Continental drift, Sea floor spreading	(10 periods)
Plate tectonics: Concept, Characteristics of plates, Plate boundaries- Divergent, Convergent & Transform faults. Causes of Plate motion	(10 periods)

#### Reference Books:

1. The Dynamic Earth System - A.M. Patwardhan
2. General Geology- V. Radhakrishna
3. Aspects of Tectonics - K.S. Valdiya

**Paper X: Geomorphology (100 Marks) (45 periods)**

Introduction to geomorphology, Modern concepts of geomorphology	
Relationship between landforms and underlying rocks	(12 periods)
Cycle of Erosion: Cyclic concept, Cycle of erosion: meaning and landscape evolution (Evidences), Rejuvenation: static and eustatic Topographic evidences of rejuvenation, polycyclic relief.	(12 periods)
Slope: geometric properties, types and classification.	(11 periods)
Mass Movements: Meaning, concept, classification on the basis of movement and material.	
Factors of mass movements, Types: Creep, Flow, slide, fall and subsidence	(10 periods)

**Reference Books:**

1. Geomorphology - Bloom A. I.
2. Principles of Geomorphology - Thornbury
3. Geomorphology – Savinder Singh

**Paper XI: Environmental Geology (100 Marks) (45 periods)**

- Definition - scope, fundamental concepts in Environmental Geology. (12 periods)
- Hazardous Earth Processes - River flooding, Sea level changes, Landslides and related phenomena, volcanic activity and Coastal hazards. (12 periods)
- Geological aspects of environmental health: (11 periods)
- Mining, Surface water and Groundwater
- Disaster Management: Prevention and Mitigation. (10 periods)

**Reference Books:**

1. Environmental Geology - K.S. Valdiya
2. Environmental Geology - Keller

**Paper XII: Hydrogeology and Remote sensing (100 Marks) (45 periods)****Hydrogeology: (25 periods)**

- Hydrologic cycle, Sources of groundwater, (5 periods)
- Rock properties affecting groundwater – texture, structure, secondary structure, porosity, permeability, storage capacity, specific yield and transmissivity (5 periods)
- Use of groundwater, Vertical distribution of groundwater (5 periods)
- Geologic formations as aquifer: (5 periods)
- Types of aquifers, groundwater basins, springs – meaning and types (5 periods)

**Reference books:**

1. Groundwater geology- Todd
2. Groundwater and tube wells - S.P.Garg
3. Groundwater - K.V. Karanth,

**Remote sensing:** (20 periods)

Concept of remote sensing, Source of electromagnetic energy, electromagnetic spectrum.

(4periods)

Platforms: Air borne and Satellite, Importance of platforms in Geology

Sensors, Camera, film, Linear and multispectral scanner (4periods)

Aerial photography: forward and lateral overlap, defects in photographs. Types of aerial photographs: based on film and camera axis orientation. (6periods)

Imagery: IRS products (Main) MSS Bands- blue, Green, Red and near I.R., FCC. Stereoscopic vision and Stereoscopes; Elements of Photo recognition, Identification of land signatures on air photographs and Black and white imagery - Soil, Rocks, Vegetation, relief, drainage / water bodies (6 periods)

**Reference books:**

1. Photo geology - Pandey
2. Remote Sensing – Principles and interpretations – Sabins
3. Remote Sensing and Image Interpretations – Lillisand

**Semester VI**

**Paper XIII: Crystallography, Principles of Stratigraphy and Earth's History**

**(100 Marks) (45 periods)**

**Crystallography:**

(23 periods)

Process of crystallization, Definition of crystal, Crystal Elements: Faces, Edges, Solid Angles, Forms (Open and Closed) Zones, Law of Constancy of Interfacial Angles, Contact Goniometer , Crystallographic Axes, Axial Angles, Parameters and Indices, Law of Rational Indices. Elements of Symmetry (11 periods)

Classification of crystals in to symmetry classes

Study of following Normal Symmetry Classes (12 periods)

- |                                    |                                      |
|------------------------------------|--------------------------------------|
| 1) Isometric System (Galena Type), | 2) Hexagonal System (Beryl Type),    |
| 3) Tetragonal Type (Zircon Type)   | 4) Orthorhombic System (Barite Type) |
| 5) Monoclinic System (Gypsum Type) | 6) Triclinic system (Axinite Type)   |

**Reference books:**

1. Rutley's Elements of mineralogy - H.H. Read
2. Optical Mineralogy - Paul Kerr.
3. A Text book of mineralogy - Dana

**Principles of Stratigraphy and Earth's History:** (22 periods)

Introduction to Stratigraphy, Definition and Scope, Principles of Stratigraphy, Methods of Stratigraphic Correlation, Standard Stratigraphic Scale (Geological Time Scale)

(11 periods)

Stratigraphic units: Stratigraphic , Bio- Stratigraphic , Chrono-stratigraphic units. Facies concept in Stratigraphy: Lithofacies, Biofacies and Index fossils, Tectonic divisions of India

(11 periods)

**Reference books:**

1. Stratigraphy and Sedimentation - Krumbein and Sloss
2. Stratigraphy – Weller
3. Essentials of Earth's History – Stokes
4. Principles of Stratigraphy – Dunbar and Rogers
5. Fundamentals of historical geology and Stratigraphy of India - Ravindra Kumar.
6. General Geology- V. Radhakrishna

**Paper XIV: Pre - Cambrian Stratigraphy of India** (100 Marks) (45 periods)

Structure, Lithology and Economic importance of

Archean: Peninsular Gneiss and Aravallis of Rajasthan, (10 periods)

Dharwars of Karnataka, (8 periods)

Iron Ore Series of Jharkhand and Sakoli and Saucer of M.P (8 periods)

Cuddapah and Delhi group (10 periods)

Vindhyan and equivalents (9 periods)

**Reference Books:**

1. Fundamentals of historical geology and Stratigraphy of India -- Ravindra Kumar.
2. Geology of Maharashtra - Edited by G.G. Deshpande
3. Geology of India- M. S. Krishnan
4. Geology of India- D.N. Wadia

**Paper XV: Phanerozoic Stratigraphy of India** (100 Marks) (45 periods)

Structure, Lithology, Paleontological characters and Economic importance of

Gondwana (8 periods)

Deccan Trap (8 periods)

Laterites, lameta and Bagh beds	(6 periods)
Jurassic of Kutch, Cretaceous of Trichy	(6 periods)
Paleozoic and Mesozoic of Spitti and Siwalik group	(10 periods)
Stratigraphy of Maharashtra	(7 periods)

**Reference Books:**

1. Fundamentals of historical geology and Stratigraphy of India -- Ravindra Kumar.
2. Geology of Maharashtra - Edited by G.G. Deshpande
3. Geology of India- M.S. Krishnan
4. Geology of India- D.N. Wadia

**Paper XVI: Economic Geology (100 Marks) (45 periods)**

Processes of formation of mineral deposits (Indian examples) and Mineral Economics

Materials of metalliferous and non-metalliferous deposits (6 periods)

Processes of formation of mineral deposits:

Magmatic concentration, (6 periods)

Contact metasomatism, (5 periods)

Hydrothermal processes, (5 periods)

Oxidation and Supergene enrichment, (5 periods)

Residual and Mechanical Concentration (5 periods)

National mineral policy of India (1990): basic objectives and salient features (in brief)

(6 periods)

Conservation of mineral resources, concept, growth of awareness, means of conservation and limitations. (7 periods)

**Reference Books:**

1. Economic mineral deposits- Jenson and Bateman A.M.
2. India's Mineral resources- S. Krishna swami
3. An introduction to mineral economics - Chatterjee K.K.
4. Mineral economies- R.K. Sinha and N.L. Sharma

## Syllabus of B.Sc. Part-III- Geology

**Practical Course (400 Marks)**  
**(Annual Pattern) (280 External + 120 Internal)**

**Practical – I (60 Practical)**

### Unit I - Optics and Mineralogy

#### **i) Optics:**

1. Types and determination of extinction angle :
  - 1) Hornblende 2) Augite 3) Diopside 4) Tremolite
2. Determination of sign of elongation:
  - 1) Sillimanite 2) Actinolite 3) Staurolite 4) Biotite 5) Tourmaline
3. Study of interference figure of uniaxial minerals and their optic sign:
  - 1) Quartz 2) Calcite

#### **ii) Mineralogy (Microscopic):**

- 1) Olivine 2) Hypersthene 3) Enstatite 4) Augite 5) Diopside 6) Actinolite 7) Tremolite 8) Hornblende 9) Muscovite 10) Biotite 11) Orthoclase 12) Microcline 13) Sanidine 14) Plagioclase 15) Leucite 16) Nepheline 17) Quartz 18) Calcite 19) Tourmaline 20) Staurolite 21) Garnet 22) Kyanite 23) Sillimanite 24) Andalusite 25) Sphene 26) Epidote 27) Chlorite.

#### **iii) Ores and Industrial minerals (Megascopic):**

**Ores:** 1) Pyrolusite 2) Psilomelane 3) Rhodocrosite 4) Hematite 5) Magnetite 6) Pyrite 7) Ilmenite 8) Goethite 9) Chalcopyrite 10) Native-copper 11) Braunite 12) Malachite 13) Azurite 14) Galena 15) Sphalerite 16) Chromite 17) Cinnabar 18) Realgar 19) Orpiment 20) Wolframite 21) Bauxite 22) Stibnite.

**Industrial minerals:** 1) Quartz 2) Beryl 3) Barite 4) Asbestos 5) Mica 6) Calcite 7) Gypsum 8) Magnesite 9) Kaolin 10) Corundum 11) Zeolite 12) Kyanite 13) Sillimanite 14) Andalusite 15) Garnet 16) Graphite 17) Zircon 18) Feldspar 19) Talc 20) Sulphur 21) Fluorite 22) Dolomite 23) Olivine.

#### **Unit - II: Mineral calculation:**

- 1) Determination of type of pyroxene with the help of Hess method and diagram from a given chemical data.
- ii) Determination of type of plagioclase feldspar from a given chemical data.

### **Unit – III - Paleontology:**

A) Identification and description of the following **Invertebrate fossils**:

1. Phylum - Coelentrata – 1) Favosite, 2) Tubipora.
2. a. Phylum - Mollusca, Class- Lamellibranchia –
  - 1) Graphea 2) Pecten 3) Cardium 4) Trigonia 5) Inoceramus 6) Cardita
2. b. Phylum - Mollusca, Class - Gastropoda –
  - 1) Voluta 2) Conus 3) Physa 4) Turritella 5) Troches 6) Turbo 7) Cyprea
2. c. Phylum - Mollusca, Class - Cephalopoda –
  - 1) Nautilus 2) Goniatites 3) Acanthoceras 4) Belemnites
3. Phylum – Brachiopoda – 1) Productus, 2) Lingula, 3) Terebratula, 4) Rhynchonella, 5) Spirifer
4. Phylum. - Echinodermata – 1) Echinus, 2) Holaster, 3) Hemiaster, 4) Micraster,
5. Phylum - Arthropoda – 1) Trilobites, 2) Paradoxide, 3) Trinucleus and 4) Ogygia

B) Identification and description of the following **Plant fossils** –

- 1) Calamites 2) Lepidodendron 3) Sigillaria 4) Vertebraria 5) Glossopteris
- 6) Gangamopteris 7) Neuropteris 8) Nissonia 9) Ptilophyllum

### **Unit IV: Structural map and problems**

- 1) Completion of Outcrops (Single inclined series) and Vertical Fault and Intrusion.
- 2) Drawing of geological Section and description of geological history of the given maps.
- 3) Solving borehole problems by graphical and contour methods

### **Practical – II**

**(60 Practical)**

### **Unit V – A - Study of Rocks - Megascopic Identification**

#### **1. Igneous rocks:**

Granites and its varieties 2) Pegmatite 3) Obsidian 4) Pumice 5) Rhyolite 6) Granodiorite 7) Diorite 8) Andesite 9) Pitchstone 10) Syenite porphyry 11) Trachyte 12) Gabbro 13) Dolerite 14) Basalts and its varieties 15) Dunite 16) Lamprophyre 17) Felsite 18) Norite 19) Peridotite 20) Anorthosite

#### **2. Secondary and sedimentary rocks:**

1) Laterite 2) Bauxite 3) Breccia 4) Conglomerate 5) Grit 6) Arkose, 7) Siliceous sandstone 8) Ferruginous sandstone 9) Flagstone 10) Shale 11) Mudstone 12) Limestone 13) Oolitic

limestone 14) Shelly limestone

**3. Metamorphic rocks:**

1) Slate 2) Phyllite 3) Sericite schist 4) Chlorite schist 5) Mica schist 6) Mica garnet Schist 7) Kyanite schist 8) Graphite schist 9) Hornblende schist 10) Actinolite schist 11) Tremolite Schist 12) Amphibolite 13) Fuschite quartzite 14) Hematite quartzite 15) Marble 16) Schorl 17) Granite gneiss 18) Garnetiferous gneiss 19) Augen gneiss 20) Hornblende gneiss 21) Charnokite

**UNIT- V- B - Study of Rocks –**

**Microscopic Identification**

**1. Igneous rock:**

1) Granite 2) Dolerite 3) Gabbro 4) Basalt 5) Dunite 6) Anorthosite 7) Peridotite 8) Lamprophyre 9) Syenite 10) Trachyte 11) Diorite 12) Andesite 13) Norite

**2. Sedimentary rocks:**

1) Sandstone 2) Ferruginous sandstone 3) Arkose 4) Limestone 5) Shelly limestone 6) Oolitic Limestone

**3. Metamorphic Rocks:**

1) Chlorite schist 2) Mica garnet schist 3) Sillimanite schist 4) Kyanite schist 5) Charnockite 6) Quartzite 7) Amphibolite 8) Hornblende gneiss 9) Granite gneiss 10) Augen gneiss

**UNIT– V- C - Study of Rocks –**

**Origin and description of the following structures and textures**

**i) Megascopic Identification (Textures and Structures)**

**1. Igneous rocks:**

1) Granitic 2) Porphyritic 3) Glassy 4) Vesicular 5) Amygdaloidal 6) Flow 7) Ropy 8) Graphic 9) Columnar

**2. Sedimentary rocks :**

1) Clastic 2) Lamination 3) Graded bedding 4) Cross bedding 5) Ripple marks 6) Mudcracks 7) Pisolitic 8) Oolitic

**3. Metamorphic rocks:**

1) Slaty cleavage 2) Schistose 3) Granulose 4) Gneissose 5) Augen 6) Cataclastic

**ii) Microscopic Identification (Textures)**

**Igneous rocks:** 1) Granitic 2) Porphyritic 3) Ophitic 4) Subophitic 5) Graphic 6) Intergranular 7) Intersertal 8) Flow 9) Reaction rim 10) Corona

**Sedimentary rocks:** 1) Clastic 2) Oolitic

**Metamorphic rocks:** 1) Slaty cleavage 2) Schistose 3) Granulose 4) Gneissose 5) Augen

### **Unit VI: Petrochemical calculation and computer application.**

**A) Petrochemical calculations** - from given chemical analysis of rocks.

1. Determination of CIPW Norms (Over saturated rocks) and classification,
2. Determination of Niggli values up to quartz Values and classification
3. Determination of ACF and plotting on triangular diagrams (compare with standard diagram from Winkler)
4. Plotting of sediment logic size analysis data on histogram and frequency curves, mode and mean, Folk and Ward's (1957) graphic measures mean, size and standard deviation. Significance of this analysis be compared with std Table given by Krumbein and Sloss

**B) Computer applications:**

1. Introduction to fundamental stastical applications to geology – Viz. -Mean, Mode, Median and standard deviation and variance.
2. Computer fundamentals- Information technology, Hardware concepts, Classification of computers and computer loft wares. Introduction to DOS (Disc operating system) and DOS commands.
3. Introduction to problem solving, flow chart, branching and looping.
4. Windows (Software programmer Introduction to windows Operating system, working with windows excel, solving petrochemical calculations and geomorphic analysis, Preparation of histograms, Line, Bar, Pie charts.

### **Unit VII : Geomorphology, Toposheet reading, Drainage analysis and remote Sensing techniques**

1. Identification and description of features from Toposheet:
  - 1) Mesa 2) Butte 3) Ridge 4) Questa 5) Meander 6) Incised meander 7) Point bar
2. Determination of - 1) Drainage patterns 2) drainage density and its significance
3. Determination of - Drainage basin analysis- 1) Stream Order (Strahler's method) 2) Stream number 3) Stream length, 4) Basin area, 5) Basin area ratio, 6) Drainage density 7) Bifurcation and their significance
4. **Remote sensing techniques: Arial photographs and satellite imagery:**
  1. Photo scale determination with the help of Toposheet
  2. Determination of photo coverage- Forward and lateral overlap.

3. Stereoscopes - Lens and mirror,
4. Orientation of Photo pair - under stereoscope.
5. Recognition of Photo elements- study of aerial photographs characteristics  
Relief, Tone, Size, Shape etc; and their significance
6. Terrain features identifications:
  - a) Drainage - Drainage patterns, density and its significance
  - b) Landforms - Mesa. Butte. Ridge and Questa
  - c) Lineaments - Stream (Tonal contrast and Topographic contrast)
  - d) Structures - Tectonic features

### **Unit VIII : Field Studies and Study tour**

Geological fieldwork in selected areas as specified in paper VII- Indian Stratigraphy, for about 15 days under guidance is compulsory. Short tours of 1day or multiple may be considered equivalent, subject to the jurisdiction of Examiners as special case.

Submission of field work report along with specimen collection is compulsory.

Field project: Related to geology like Well inventory. Resistivity survey in the area or any other work related to geology.

### *Nature of practical examination for B.Sc. III-Geology*

Practical examination will consist of total 280 marks.

The examination will be conducted on Two days, as follows:

#### **Unit –I- (First day)**

Section I	Mineral calculations	Hess	06 marks
		Plagioclase	06 marks
Section II	Mineral identification	Megascopic	15 marks
		Microscopic	15 marks
Section III	Crystallography		18 marks
Section IV	Maps	Map section	10 marks
		Outcrop completion	10 Marks
		Graphical method	10 marks.
		Contour problem	10 marks.
Section V	Project report/field work		20 marks.
	Viva voce		10 marks.
	Journal		10 marks.
		<b>Total</b>	<b>140Marks</b>

#### **Unit –II- (Second day)**

Section I	Petrology	Microscopic	12 marks
		Megascopic	14 marks.
Section II	Textures and structures	Microscopic	16 marks.
		Megascopic	14 marks
Section III	Photo geology		12 marks.
	Optics		12 marks.
Section IV	Petrochemical	Norm	10 marks.
	calculation	Niggli	10 marks.
		ACF/AKF	10 marks.
		Sedimentary size analysis	10 marks.
		Drainage analysis	10 marks
		Toposheet reading	10 marks
		<b>Total</b>	<b>140 marks</b>

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## **-Examination Structure-**

### **Theory examination**

1. The **Entire Theory examination** will consists of **EIGHT Papers**  
**FOUR Papers in Each Semester** (5<sup>th</sup> and 6<sup>th</sup>)  
(Internal examination of 30 marks each paper per semester –  
Totaling to 240 marks)
  2. **Each paper of 70 marks** - As per University common pattern for  
Science faculty
  3. **Time - 3hours per theory paper**
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### **Annual Practical examination at the end of year (6<sup>th</sup> semester)**

#### **Practical Examination**

1. **Practical examination will be conducted annually i.e. at the end of sixth semester only.**
2. **It will be conducted for total 280 marks**
3. **Two separate days for Two Practical (Each practical with 140 marks)**
4. **Time – 5 hours per practical paper**