Solapur University, Solapur

Syllabus for B.Sc. III – Geology

Semester System

To be implemented from Academic Year- 2012 – 2013

Course Structure

Sr. No.	Semester	Paper No.	Title	No. of Lecture	Total Marks
1	Semester V	IX	Earth's Physics and Dynamics	40	50
		X	Geomorphology	40	50
2	Semester V	XI	Environmental Geology	40	50
		XII	Hydrogeology and Remote Sensing	40	50
3	Semester VI	XIII	Crystallography, Principles of Stratigraphy and Earth's History	40	50
		XIV	Pre-Cambrian Stratigraphy of India	40	50
4	Semester VI	XV	Phanerozoic Stratigraphy of India	40	50
		XVI	Economic Geology	40	50
5	At the end of IV Semester		Practical Examination (Annual Pattern)	100 practical	200
				Total	600

Solapur University, Solapur

Syllabus for B.Sc. III – Geology

Semester System

To be implemented from Academic Year- 2012 – 2013

Theory

Semester V

Paper IX: Earth's Physics and Dynamics **(50 Marks) (40 periods)**

Crustal movements: Orogenic and Epeirogenic movements. (6 periods)

Types of mountains and their origin –

Volcanic, fold (Orogenic), Block and Denudational. (10 periods)

Isostasy, (6 periods)

Continental drift, Sea floor spreading. (8 periods)

Plate tectonics: Concept, Characteristics of plates, Plate boundaries- Divergent, Convergent, Transform faults. Plate motion: causes. (10 periods)

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

Paper X: Geomorphology **(50 Marks) (40 periods)**

Introduction to geomorphology, Modern concepts of geomorphology.

Relationship between landforms and underlying rocks. (10periods)

Cycle of Erosion: Cyclic concept, Cycle of erosion: meaning and landscape evolution (Evidences), Rejuvenation: static and eustatic Topographic evidences of rejuvenation, polycyclic relief. (10periods)

Slope: geometric properties, types and classification. (10periods)

Mass Movements: Meaning, concept, classification on the basis of movement and material. Factors of mass movements, Types: Creep, Flow, slide, fall and subsidence

(10periods)

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

Paper XI: Environmental Geology **(50 Marks)**
(40 periods)

Definition - scope, fundamental concepts in Environmental Geology. (10periods)

Hazardous Earth Processes - River flooding, Sea level changes, Landslides and related phenomena, Volcanic activity and Coastal hazards. (10periods)

Geological aspects of environmental health: (10periods)

-Mining, Surface water and Groundwater

Disaster Management: Prevention and Mitigation. (10periods)

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

Paper XII: Hydrogeology and Remote Sensing **(50 Marks)**
(40 periods)

Hydrogeology: (20periods)

Hydrologic cycle, Sources of groundwater, (4periods)

Rock properties affecting groundwater – texture, structure, secondary structure, porosity, permeability, storage capacity, specific yield and transmissivity. (6periods)

Use of groundwater. Vertical distribution of groundwater. (4periods)

Geologic formations as aquifer: (6periods)

types of aquifers, groundwater basins, springs – meaning and types.

Reference books:

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

Remote sensing: (20periods)

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. Photogeology - Pandey
2. Remote Sensing – Principles and interpretations – Sabins
3. Remote Sensing and Image Interpretations – Lilisand

Semester VI

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

(50 Marks)
(40 periods)

Crystallography: (20 periods)

Process of crystallisation. Definition of crystal. Crystal Elements: Faces, Edges, Solid Angles, Forms (Open and Closed) Zones, Law of Constancy of Interfacial Angles, Contact Goniometers, Crystallographic Axes, Axial Angles, Parameters and Indices, Law of Rational Indices. Elements of Symmetry. (10 periods)

Classification of crystals in to symmetry classes. Study of following Normal Symmetry Classes. (10 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 or mineralogy H.II. Read
2. Optical Mineralogy Paul Kerr.
3. A Text book of mineralogy- Dana

Principles of Stratigraphy and Earth's History: (20 periods)

Introduction to Stratigraphy. Definition and Scope, Principles of Stratigraphy, Methods of Stratigraphic Correlation, Standard Stratigraphic Scale (Geological Time Scale). (10 periods)

Stratigraphic units: Stratigraphic, Bio- Stratigraphic, Chrono-stratigraphic units.

Facies concept in Stratigraphy: Lithofacies. Biofacies and index fossil. Tectonic divisions of India. (10 periods)

Reference books:

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

Paper XIV: Pre- Cambrian Stratigraphy of India **(50 Marks)**
(40 periods)

Structure, Lithology, Paleontological characters and Economic importance of
Archean: Peninsular Gneiss and Aravallis of Rajasthan, (8periods)
Dharwars of Karnataka, (8periods)
Iron Ore Series of Jharkhand and Sakoli and Saucer of M.P. (8periods)
Cuddapah and Delhi group (8periods)
Vindhyan and equivalents (8periods)

Paper XV: Phanerozoic Stratigraphy of India **(50 Marks)**
(40 periods)

Structure, Lithology, Paleontological characters and Economic importance of
Gondwana, (6periods)
Deccan Trap, (6 periods)
Laterites, lameta and Bagh beds, (4 periods)
Jurassic of Kutch, Cretaceous of Trichy. (6 periods)
Paleozoic and Mesozoic of Spiti, Siwalik group. (12 periods)
Stratigraphy of Maharashtra (6 periods)

Reference Books:

1. Fundamentals of historical geology and Stratigraphy of lndia -- 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 **(50 Marks)**
(40 periods)

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

Materials of metalliferous and non-metalliferous deposits. (5 periods)

Processes of formation of mineral deposits:

Magmatic concentration, (5 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). (5 periods)

Conservation of mineral resources, concept, growth of awareness, means of conservation and limitations. (5 periods)

Reference Books:

4. Economic mineral deposits- Jenson and Bateman A.M.
5. India's Mineral resources- S. Krishnaswami.
6. An introduction to mineral economics-Chatterjee K.K,
7. Mineral economies- R, K, Sinha and N.L, Sharma.

Syllabus of B.Sc. Part-III- Geology

Practical Course (100 Practical)
(Annual Pattern)

Practical - I

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 and Paleontology

i) Mineral Calculations:

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.

ii) 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) Rhynconella, 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)Calamites2) Lepidome1ane 3) Siggilaria 4) Vertibraria 5) Glossopteris 6) Gangamopteris 7) Neuropteris 8) Nissonia 9) Ptilophyllum

Unit III – A- Study of Rock- Megascopic Identification

1. **Igneous rocks:**

   1)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

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

C- Study of Rocks- Origin and description of the following structure and texture.

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)

1. **Igneous rocks:**

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

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

3. **Metamorphic rocks:**

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

Unit IV: 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 stastica1 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 V: Geomorphology, Toposheets 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 VI: 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

Unit VII: 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.

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.

- Examination Structure -

1 The **Entire Theory examination** will consists of **Eight Papers.**

Four Papers in **Each Semester**.

2 **Each paper of 50 marks**

3 **Nature of Theory Question Paper: (All questions are compulsory)**

Time: 2hours **Total marks: 50**

Q.No.1) Multiple choice questions. **(10)**

1) ----------

a) b) c) d)

2)
3)
4)
5)
6)
7)
8)
9)
10)

Q.No.2) Answer any Five of the following **(10)**

i)
ii)
iii)
iv)
v)
vi)

Q.No.3) A) Answer any Two of the following **(06)**

i)
ii)
iii)

B) Write the Answer/Solve/Problem/Note **(04)**

Q.No.4) Answer any Two of the following **(10)**

i)
ii)
iii)

Q.No.5) Answer any Two of the following **(10)**

i)
ii)
iii)

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

Practical examination will consist of total 200 marks.

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

Unit –I- (First day)

Section I	Mineral calculations	Hess	05 marks
		Plagioclase	05 marks
Section II	Mineral identification	Megascopic	10 marks
		Microscopic	10 marks
Section III	Crystallography		12 marks
Section IV	Maps	Map section	10 marks
		Outcrop completion	08 Marks
		Graphical method	05 marks.
		Contour problem	05 marks.
Section V	Project report/field work		20 marks.
	Viva voce		10 marks.
	Journal		20 marks.
		Total	**120**Marks

Unit –II- (Second day)

Section I	Petrology	Microscopic	08 marks
		Megascopic	07 marks.
Section 11	Textures and structures	Microscopic	08 marks.
		Megascopic	07 marks
Section III	Photogeology		12 marks.
	Optics		08 marks.
Section IV	Petrochemical calculation~	Norm	06 marks.
		Niggli	04 marks.
		ACF/AKF	04marks.
		Sedimentary size analysis	06 marks.
		Drainage analysis	06 marks
		Toposheet reading	04 marks
		Total	**80Marks**