

# Savitribai Phule Pune University

## S.Y. B. Sc. Geology Syllabus Structure

### S.Y.B.Sc. Geology CBCS syllabus: June 2020 Pattern

Paper no.	Title of the paper	Credit
GL 211	Structural Geology	2
GL 212	Principles of Stratigraphy and Sedimentation	2
GL 213	Practicals related to GL 211 & 212	1.5
GL 221	Global Tectonics and Geodynamics of the lithosphere	2
GL 222	Environmental Geology and Geogenic disasters	2
GL 223	Practicals related to GL 221 & 222	1.5

### S.Y.B.Sc. Geology CBCS syllabus: June 2021 Pattern

Paper no.	Title of the paper	Credit
GL 211	Structural Geology	2
GL 212	Palaeontology	2
GL 213	Practicals related to GL 211 & 212	1.5
GL 221	Global Tectonics and Geodynamics of the lithosphere	2
GL 222	Environmental Geology and Geogenic disasters	2
GL 223	Practicals related to GL 221 & 222	1.5

Note:

1. The students enrolled for F. Y. B. Sc. Geology in the academic year 2019-2020, will go with June 2020 pattern.
2. The students who will enrol for F. Y. B.Sc. Geology in the academic year 2020-2021, will go with June 2021 pattern for S. Y. B. Sc.
3. June 2021 pattern with continue till further syllabus revision.

(2021 Pattern)

**SEMESTER - III**  
**CC - V**  
**GL 211: Structural Geology (2 Credits)**

- (i) **Course learning outcome:** The course deals with geological structures resulting from the action of these forces on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.
- (ii) **Broad contents of the course:** The course is designed for the students to understand the geometry and mechanics of the various geological structures that result through the deformative processes operative within the earth.
- (iii) **Skills to be learned:** The students learn the skills of identifying different structures and measurements using Brunton compass which are fundamental to geological mapping. This course also helps to know how to use structures and help students' appreciate the dynamic nature of the Earth's lithosphere, learn how geologic maps are read and solve simple map problems using strike and preparations of cross sections.

Topic	No. of lectures
<b>Credit 1: Fundamental Principles of Structures</b>	
<b>A.</b> Attitude of a planar feature : a) Strike and dip (true dip and apparent dip). b) Strike-dip symbols for inclined, horizontal and vertical strata. c) Rake and plunge.	2
<b>B.</b> Brunton Compass, Clinometer Compass and GPS. a) Elements of a Brunton Compass and Clinometer Compass. b) Use of GPS. c) Strike direction, dip direction and dip amount. d) Fore-bearing and back-bearing.	2
<b>C.</b> Stress and Strain. a) Definition and concept of stress and strain. b) Three stages of deformation (Hooke's Law). c) Understanding stress and strain with reference to elastic and plastic deformation. d) Brittle and ductile deformation. e) Introduction to Stress-strain diagram.	5
<b>D.</b> Factors controlling rock deformation. a) Factors controlling behavior of materials such as – temperature, time, pressure (confining pressure and pore pressure), solution	6

and strain rate.	
<b>E.</b> Introduction to rock deformation and its mechanics. a) Definition of rock deformation. b) Components of rock deformation (Translation and Rotation) c) Definition and examples of plastic deformation. d) Mechanism of plastic deformation: Intergranular and intragranular movements, recrystallization with and without change in shape (Reckie's principle).	3
	<b>Total: 18</b>
<b>Credit 2: Introduction to Structural Features</b>	
<b>A.</b> Joints. a) Definition and types of joints. b) Geometric and Genetic classification of Joints.	2
<b>B.</b> Fractures. a) Concept of fracture. b) Genetic types of fracture (tension and shear fracture). c) Fracturing under differential forces.	2
<b>C.</b> Shear Zones. a) Definition and types of shear zone (Simple and compound). b) Ideal plastic shear zone. c) Mylonites d) Shear zone indicators (Porphyroclast with recrystallized tails, S-C structure, Mica-fish, Imbrications and Boudinage).	3
<b>D.</b> Faults. a) Terminologies associated with fault plane. b) Nature of movement along faults (Translational and Rotational). c) Effects on disrupted strata. d) Calculation of net slip. e) Concept of throw and heave. f) Classification of faults (Geometric and Genetic)	5
<b>E.</b> Folds. a) Definition and parts of a fold. b) Nomenclature of folds. c) Plunging and Non-plunging folds. d) Types of folds (Flexure, shear and flow). e) Recognition of folds and plotting attitude of beds on a map. f) Determination of top of beds by Primary sedimentary structures. g) Classification of folds (Geometric and Genetic).	6
	<b>Total: 18</b>

### Books Recommended:

1. Ramsay, J.G. (1967) Folding and fracturing of rocks. McGraw-Hill, New York
2. Jain, A.K., (2014) An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore.
3. Billings, M.P., (1972) Structural Geology. Prentice Hall.

4. Fossen, H., (2010) Structural Geology. Cambridge University Press.
5. Davis, G.R., (1984) Structural Geology of Rocks and Region. John Wiley
6. Singh, R. P., (1995) Structural Geology: A Practical Approach. Ganga Kaveri Publ., Varanasi
7. Hills, E.S., (1963) Elements of Structural Geology. Farrold and Sons, London.

(2021 Pattern)

**SEMESTER - III  
CC-VI**

**GL 212: Palaeontology (2 Credits)**

- (i) **Course learning outcome:** The study of Palaeontology encompasses aspects such as the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time. The knowledge of palaeontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations.
- (ii) **Broad contents of the course:** Palaeontologists study the fossils which have been preserved in the earth's crust by natural processes and are used to fingerprint a large chunk of the age of the earth in terms of time. Palaeontology encompasses study of micro-fossils, plant fossils, vertebrate and invertebrate fossils and their evolution. These aspects are fundamental not only to Geology and Stratigraphy but to inter-disciplinary fields of Paleobotany, Paleozoology and Evolutionary Biology.
- (iii) **Skills to be learned:** The students will acquire skills of discovering and describing fossils and their taxonomic classification. They will also be introduced to interpretation of Paleoclimate and Paleoenvironment conditions.

Topic	No. of lectures
<b>Credit 1: Introduction to Palaeontology and Palaeobotany</b>	
<b>F.</b> Geological Time Scale. d) Concept of Eon, Era, Period and Epoch. e) Introduction to International Chronostratigraphic Chart (IUGS).	1
<b>G.</b> Origin of life on Earth. e) Introduction to Stromatolites. f) Explosion of life (Pre-cambrian – Cambrian boundary). g) Major extinctions of Geological time (P-T boundary and K-T boundary extinction).	3
<b>H.</b> Evolution of life with time. f) Evidence of evolution (Macro and Micro evolution). g) Mutation. h) Life through Precambrian and Phanerozoic Eons.	4
<b>I.</b> Introduction to fossils. e) Definition of fossils (Megafossils, Microfossils and Ichnofossils). f) Branches of Palaeontology.	5

g) Conditions necessary for fossilization. h) Modes of preservation of fossils. i) Uses of fossils. j) Collection and preparation of fossils (Field and laboratory techniques for mega and microfossils).	
<b>J.</b> Index fossils. b) Definition and examples of index fossils, c) Use of index fossils.	1
<b>K.</b> Classification, morphological characters and geographical distribution of the following plant fossils: a) <i>Glossopteris</i> b) <i>Ptilophyllum</i> c) <i>Gangamopteris</i> d) <i>Nilsonia</i> e) <i>Dicroidium</i> f) <i>Schizoneura</i>	4
	<b>Total: 18</b>
<b>Credit 2: Introduction to Megapalaeontology and Micropalaeontology</b>	
<b>F.</b> Classification, morphological characters and Geographical distribution of the following invertebrate fossils from <b>Phylum Mollusca</b> : a) Class Bivalvia b) Class Gastropoda c) Class Cephalopoda (Nautilus, Ammonoites, Belemnites).	6
<b>G.</b> Classification, morphological characters and Geographical distribution of the following invertebrate fossils from: a) Phylum Brachiopoda. b) Phylum Arthropoda (Evolutionary trend of <i>Trilobite</i> ). c) Phylum Echinodermata. d) Phylum Coelenterata.	6
<b>H.</b> Micropalaeontology. a) Branches of Micropalaeontology and its uses. b) Introduction to Palynology (Morphology of pollens and spores).	2
<b>I.</b> Classification and morphological characters of the following microfossils with environmental and palaeo-ecological significance: a) Foraminifera. b) Ostracoda. c) Diatoms.	2
<b>J.</b> Classification, morphological characters and Geographical distribution of the following vertebrate fossils: a) Man b) Dinosaur (eggs and bones)	2
	<b>Total: 18</b>

### Books Recommended:

1. Cowen, R. (2000) History of Life, Blackwell Science.
2. E. N. K. Clarkson, (2013) Invertebrate palaeontology and Evolution, Blackwell Science
3. Rhona M. Black, (1989) The Elements of Palaeontology, Cambridge University Press
4. Michael Benton, (2005) Vertebrate Palaeontology, Blackwell Publishing

5. Patrick Wyse Jackson, (2019) *Introducing Palaeontology: A Guide to Ancient Life*, Dunedin Academic Press Ltd.
6. Raymond Enay (2012) *Palaeontology of Invertebrates*, Springer-Verlag.
7. Peter Doyle, *Understanding Fossils: An Introduction to Invertebrate Palaeontology*.
8. Morley Davies (2008) *An Introduction to Palaeontology*, Read Books.
9. Sreepat Jain (2017) *Fundamentals of Invertebrate Palaeontology: Macrofossils*, Springer India
10. Roland Goldring, (2014) *Field Palaeontology*, Routledge
11. Johansson, C. Z., Underwood, M. Richter, (2019) *Evolution and development of Fishes*, Cambridge University Press.
12. Pratul Kumar Saraswati, M.S. Srinivasan, (2016) *Micropaleontology: Principles and Applications*, Springer International Publishing Switzerland.
13. Michael Benton, David A. T. Harper, (2009) *Introduction to Paleobiology and the Fossil Record*, Wiley-Blackwell.
14. Colbert, E.H. and Minkoff, Eli C. (2001) *Evolution of vertebrates*, Wiley Liss

(2021 Pattern)

GL 213: Practicals related to GL 211 and GL 212

Topic	No. of Practicals
<b><u>A: Study of Geological Maps involving:</u></b> a) One conformable and two conformable series. b) One conformable series with a vertical fault. c) One unconformity and one vertical fault / dyke. d) Completion of outcrop with the help of given topographic and lithological data. <b><u>Note:</u></b> One junction line may be partly shown with geologic / stratigraphic column.	4
<b><u>B: Structural Problems:</u></b> a) Problems involving hill slope (hill slope given / hill slope to be determined), true dip, true thickness, true width of outcrop and vertical thickness of bed. b) Problems involving true and apparent dip, true and apparent thickness, true and apparent width of outcrop and vertical thickness of bed (true dip and true thickness / vertical thickness / width of outcrop given). c) Problems involving hill slope, attitude of the exposures of top and bottom of the bed on the hill slope along with true thickness of the bed given, finding out true dip direction, true dip amount and other geometrical parameters of the bed. Comment on normal or overturned bed. d) Three point problems – drill hole data for a hidden planar feature at three non – collinear points given in the form of location, elevation and absolute depth of planar feature, finding out strike, true dip direction and true dip amount of the planar feature. To determine one of three parameters where the other two parameters are known.	3
<b>Topic</b>	
<b><u>A: Palaeontology:</u></b> e) Study of Invertebrate fossils (Phylum Mollusca). f) Study of Invertebrate fossils (Phylum Brachiopoda, Phylum Arthropoda, Phylum Echinodermata and Phylum Coelenterata). g) Study of microfossils and plant fossils ( <b>3</b> microfossils, <b>3</b> plant fossils, <b>1</b> pollen/spore/diatom).	3
	<b>Total: 10</b>



(2021 Pattern)

**SEMESTER - IV**

**CC-VII**

**GL – 221: Global Tectonics and Geodynamics of the lithosphere (2 Credits)**

**(i) Course learning outcome:**

This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.

**(ii) Broad contents of the course:**

This course develops the concepts of plate tectonics on a global scale and analyses the physical processes responsible for the formation and destruction of the plates.

**(iii) Skills to be learned:**

The student will be introduced to the structure of the continental crust vs. oceanic crust and their geodynamic. They will also appreciate the modern concept of plate tectonics and its implications.

Topics	Lectures
<b>Credit I: Geodynamics of the lithosphere</b>	
<b>Evolution of earth</b> Composition, physical properties & characteristics of three spherical zones of the Earth namely crust, mantle and core	3
<b>Structure of the lithosphere</b>	2
lithosphere-asthenospheric interactions, Concept of Lithosphere, Asthenosphere & Mesosphere	3
Low Velocity Zone (LVZ)	2
Continental crust and Oceanic crust	3
Geotherms	2
Concepts of isostasy	3
	Total 18
<b>Credit II : Global Tectonics</b>	
Direct & indirect observations in exploration of Earth's interior	3
Concept of Shield and Platform Early crustal evolution of the earth and Introduction to concepts of Cratons, Shields, Platform, Mobile belt with suitable Indian examples	3

Continental drift	2
Morphology of Ocean floor	2
Ocean floor spreading a) Magnetic anomalies & sea floor Spreading- Mechanics & applications	2
Plate tectonics a) Introduction to Wilson's cycle & Concept of plate tectonics b) Characteristic features of plate boundaries	3
Different tectonic settings on Earth-Mid Oceanic Ridges, Rift valleys and Island arcs (compressional and extensional)	3
	Total 18

**Books Recommended:**

1. Patwardhan, A.M. (2012) The dynamic Earth System, PHI Learning Pvt. Ltd.,
2. Moores E.M. and Twiss R.J. (1995) Tectonics, W. H. Freeman
3. Valdiya, K.S., (1984) Aspects of Tectonics: Focus on Southcentral Asia, Tata-McGraw Hill, New Delhi,
4. Belousov, V.V. (1980) Geotectonics, Springer-Verlag Berlin Heidelberg
5. Condie, K.C. (1989) Plate Tectonics & Crustal Evolution, Butterworth-Heinemann
6. Billings, M.P. (1942) Structural Geology, Prentice Hall,
7. Badgley, P. C. (1965) Structural & Tectonic Principles, Harper & Row
8. Valdiya K.S. (2014) Making of India, Springer.
9. Valdiya K.S. (1984) Aspects of tectonics, Tata Mcgrath Hill.

(2021 Pattern)

**SEMESTER - III**

**CC-VIII**

**GL - 222: Environmental Geology and Geogenic disasters ( 2 Credits)**

**(i) Course learning outcome:**

Know the basic fundamentals of earth science as applied to the interaction between human activity and the natural environment. Understand the occurrence and availability of both surface and subsurface water resources and the role of the hydrologic cycle and pollution. Understand the role of plate tectonics in causing earthquakes and how this understanding can aid the assessment of seismic hazard.

**(ii) Broad contents of the course:**

This course deals with water and its pollution and geogenic disasters.

**(iii) Skills to be learned:**

Students will be able to test and evaluate water quality for drinking and agricultural use.

They will also have knowledge about various natural disasters.

Topics	Lectures
<b>Credit I :Environmental Geology</b>	
Interaction between human activity and the natural environment Concepts, Objectives, and Scope of Environmental Geology; Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles	3
Surface and subsurface water resources	2
Hydrogeologic cycle and pollution, point, line and area sources of pollution	1
Sources of water pollution (natural and man-made), Case histories related to water pollution: Minamata disease (Japan), Arsenic poisoning (West Bengal), and Flourosis (Bhandara), Blue Baby Nitrate	3
Water quality parameters	2
BIS standards	1
Organic and inorganic pollutants,	2
Introduction to Air Pollution	1
Heavy metal pollution	1
Remedial measures	2
	Total 18
<b>Credit II : Geogenic disasters</b>	
Definition, Types, Prediction, Natural hazard zones and impact assessment,	4

Natural hazard zonation maps, Significance of Geology in Disaster Management Plan for Earthquakes	
Richter scale, Building codes and public education	2
Volcanic Hazards Origin and types of volcanic activity, Nature of volcanic hazards, Prediction of volcanic eruptions, and mitigation of volcanic hazards.	3
Cyclones and Floods Introduction, definition, classification, causative factors, vulnerability, predictability (forecasting), mitigation measures, Cyclone and flood hazards in India	2
technological approaches (e.g., dams and levees) and land-use planning approaches to avoiding flood damages	1
Droughts, meteorological, agricultural and hydrologic types, mitigation of droughts	2
Introduction, causes and types of mass movements, Identification of landslides zones, control measures, avalanches and their causes, mitigation and concept of safety factor	3
Evaluation of technologies for landslide prevention	1
	Total 18

### **Books Recommended:**

1. Verma, V.K., (1986) Geomorphology Earth surface processes and form. McGraw Hill.
2. Chorley, R. J., (1984) Geomorphology. Methuen.
3. Selby, M.J., (1996) Earths Changing Surface. Oxford University Press UK.
4. Thornbury W. D., (1997) Principles of Geomorphology Wiley Eastern Ltd., New Delhi.
5. Valdiya, K. S., (1987) Environmental Geology - Indian Context. Tata McGraw Hill New Delhi.
6. Keller, E. A., (2000) Environmental Geology. Shales E. Merrill Publishing Co., Columbus, Ohio.
7. Montgomery, C., (1984) Environmental Geology. John Wiley and Sons, London.
8. Bird, Eric, (2000) Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.
9. Liu, B.C., (1981) Earthquake Risk and Damage, Westview.

10. Sharma J. P., Environmental Studies, Laxmi Publications (P) Ltd, New Delhi
11. Blyth, F.G.H. and M. H. de Freitas(1984)Geology for Engineers,Butterworth-Heinemann Title
12. Krynine, D.P and Judd, W.R (2005) Principles of Engineering Geology and Geotechniques, CBS Publishers & Distributors
13. Ries, H. and T. L. Watson, (1949) Elements of Engineering Geology, New York, John Wiley & Sons, Inc.

(2021 Pattern)

**SEMESTER - IV**

**GL: 223 Practicals related to GL 221 and 222**

**Practicals related to GL 221**

<b>Title of the Practical</b>	
Marking of Craton/ Mobile belts/ Platforms/ Sedimentary Basins	1
Practicals related to Mid Oceanic Ridges	1
Problems related to P & S waves – Interior of the Earth	2
Mathematical problems related to Geotherm/ Isostasy	1

**Practicals related to GL 222**

<b>Title of the Practical</b>	
To find Water Quality Index	1
Preparation of Hazard zonation maps for India and World eg; Earthquake, landslide	1
Practicals related to Air Quality Analysis	1
Slope stability analysis, landslide w.r.t. jointing pattern	1
Fieldwork Component	1