St. Xavier's College (Autonomous), Mumbai
Department of Geology

Programme: B.Sc. Geology

Programme Specific Outcomes (PSOs) for B.Sc. Geology

Sr. No.	On completing B.Sc. Geology, the student will be able to:
PSO 1	Understand the internal and external forces on our planet and how the various features, origin, evolution and preservation of life structures within rocks are formed due to Earth's various processes; identify physical properties of rocks, as well as the optical and physical properties of minerals in hand specimens as well as under the microscope.
PSO 2	Develop the knowledge regarding the basic concepts of stratigraphy in order to understand the Precambrian and Phanerozoic stratigraphy of India, along with an understanding of primary and secondary geological structures, recording and collecting data about these structures and reconstructing geological history.
PSO 3	Receive training in hydrogeology, basic meteorology and geological field techniques such as mapping and surveying required for collection, interpretation and application of the geological data.
PSO 4	Recognize the importance of remote sensing and geographic information system in data acquisition and interpretation of satellite images and aerial photographs.
PSO 5	Understand the process of formation of gem minerals and synthetic gemstones in order to develop means and ways to study, detect and identify gemstones using sophisticated instrumentation techniques.
PSO 6	Be professional geologist through exposure to theory and field exploration techniques in earth sciences.

Course Outcomes (COs): B.Sc. Geology

Semester I

Course Title: Introduction to Mineralogy and Crystallography
Course Code: SGEO0101

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the composition and basic chemistry of minerals that makeup Earth's materials.	1	U, R
CO 2	Understand how minerals are classified on the basis of their physical and chemical properties.	1, 6	U, R, Ap, An
CO 3	Applying the elementary ideas of crystal structure in understanding the external characteristics of crystals and classifying them.	1	U, Ap, An, E
CO 4	Identify important minerals that combine to form various rocks and their classification.	1, 6	U, R, Ap, An

Course Title: Introduction to Earth Science, Cartography and Structural Geology
Course Code: SGEO0102

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the formation and physical dimensions of our planet, understand its uniqueness in the solar system, considering its internal structure and position in the solar system.	1	U, An
CO 2	Understand the various surface and atmospheric phenomenon that occur on Earth, analyse their causes and effects.	1, 3	U, An, E
CO 3	Understand the cataloging of Indian topographical maps, their importance in geology and usage in geological fieldwork.	4, 6	U, R, An
CO 4	Analyse various structures that have formed in surface rocks due to the forces created within Earth's interior, identify them in the field and analyse their mode of formation.	2, 3, 6	Ap, An, E

Course Title: Geology Practicals – I
Course Code: SGEO01PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify important minerals that combine to form various rocks and their classification.	1
CO 2	Apply the elementary ideas of crystal structure in understanding the external characteristics of crystals.	1
CO 3	Use basic instruments for locating themselves in the field, and understand the use of Indian topographical maps, their importance in geology and usage in geological fieldwork.	1, 2, 3, 6

Semester II

Course Title: Introduction to Petrology, Geotectonics and Economic Geology
Course Code: SGEO0201

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify and classify rocks based on minerals present in them.	1	U, R, Ap, An
CO 2	Classify rock types based on their process of formation and structures preserved.	1, 6	U, R, Ap, An, E
CO 3	Understand various types of ore-forming processes and their relationship with tectonism.	1	U, R, Ap, An
CO 4	Understand exploration techniques used in mineral exploration, e.g., seismic- and gravity-methods.	1, 6	U, R, Ap, An

Course Title: Introduction to Physical Geology, Principles of Stratigraphy and Paleontology
Course Code: SGEO0202

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Explain the concept and importance of plate tectonics and evolution of theory of plate tectonics.	1	U, R
CO 2	Understand the difference between weathering and erosion and learn the various processes involved in weathering and erosion formation.	1	U, An
CO 3	Analyse the processes of soil, soil profile and types of soil.	1, 6	U, R, Ap
CO 4	Understand various types of landforms developed due to action of wind, rivers, glaciers and oceans.	1	U, R, Ap, An
CO 5	Understand the principles of stratigraphy, formation and preservation of fossils, and concept of geological time.	2, 1	U, R, Ap, An

Course Title: Geology Practicals – II
Course Code: SGEO02PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify and enumerate on the systematic description of megascopic features of rocks and ore minerals.	1, 6
CO 2	Learn the preparation and correlation of the lithologs, and their interpretations.	1, 2, 3

Semester III

Course Title: Stratigraphy, General and Invertebrate Paleontology
Course Code: SGEO0301

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the concepts in stratigraphic classification and know nomenclature of the various stratigraphic units.	2	U, R, Ap
CO 2	Know Walther's law of facies and its importance to application in the field.	2	U, Ap
CO 3	Understand the modern concept of origin of life, evolution, and mass extinctions.	1, 2	U, Ap
CO 4	Analyse and evaluate the preservation, types and applications of fossils and its scope.	1	U, R, Ap, An
CO 5	Describe functional morphology and evolutionary trends of major invertebrate fossils and a few type vertebrate fossils such as horse and elephant with special emphasis on dinosaur fossils in India.	1	U, R, Ap, An

Course Title: Crystallography
Course Code: SGEO0302

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basics of crystallograph;y build overall knowledge in mineralogy and optics leading to a better understanding of petrology and gemmology.	1, 5	U, An, Ap
CO 2	Understand characteristics of crystals with respect to their morphology and symmetry; know the crystal classes and possible forms in each class; be acquainted with X-Ray diffraction and crystal imperfections.	1, 5	R, E, An
CO 3	Identify common rock-forming minerals in hand specimens as well as in thin sections.	1, 6	U, Ap, An,
CO 4	Be familiar with the Bravais crystal lattice and crystal systems to understand X-ray techniques useful in identifying minerals.	1, 5	U, Ap, An,

Course Title: Geomorphology and Cartographic Analysis
Course Code: SGEO0303

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basic development of landform and various micro- and macro- processes that operate on them.	1, 3	U, R, Ap, An
CO 2	Identify various types of landforms and classify them according to agents of their formation.	1, 3	U, R, Ap, An
CO 3	Understand the basic concepts of toposheet/topographic reading and slope analysis.	1, 3	U, R, Ap, An
CO 4	Acquire knowledge about various techniques used for drainage basins and its analysis for various parameters.	1, 3, 6	U, R, Ap, An

Course Title: Geology Practicals – III
Course Code: SGEO03PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify and study (morphology and classification) of macro and microfossils along with their geological distribution.	1, 2
CO 2	Apply crystallography in various fields with special emphasis on mineralogy.	1
CO 3	Utilize the knowledge of cartographic techniques, their applications and interpretations on topographical maps.	1, 2, 6

Semester IV

Course Title: Stratigraphy, General and Invertebrate Paleontology
Course Code: SGEO0401

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the concept of mineral deposits of economic importance; know basic concepts and nomenclature and various terms related to ore minerals.	1, 6	U, R, Ap
CO 2	Classify and characterize the economically important metalliferous and non-metalliferous mineral deposits.	1	U, R,
CO 3	Aquire knowledge related to controls on mineralization, metallogenic epochs and provinces.	1, 2, 6	U, An
CO 4	Know various processes of formation of mineral deposits.	1, 2	U, R, Ap, An

Course Title: Optical Mineralogy and Systematic Mineralogy
Course Code: SGEO0402

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify and describe the physical and optical properties of common rock-forming minerals.	1	U, R
CO 2	Classify, characterize and identify the common rock- forming minerals in hand specimens and thin sections.	1, 6	U, Ap
CO 3	Understand the macroscopic properties of minerals and their relationship to crystal system, internal structure and optical properties.	1	U, Ap, An
CO 4	Understand the principle and basic functions of a petrological microscope and its use in mineral identification.	1, 6	Ap, An
CO 5	Understand various optical properties and their significance in mineral identification.	1	U, Ap
CO 6	Comprehend the role of minerals in understanding Earth's interior, geologic history and evolution.	1	Ap, An, E
CO 7	Realise the importance of minerals in society and their industrial applications.	6	U, R, Ap

Course Title: Field Geology and Hydrogeology
Course Code: SGEO0403

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the construction and working of various field equipment used in geologic surveying, recording of geological data, collecting samples and taking photographs.	1, 3, 6	U, R, Ap, An, E, C
CO 2	Map and record data in various terrains in order to prepare topographical and geological maps.	1, 4, 6	U, R, Ap, An, E, C
CO 3	Understand the concept of groundwater; learn about the occurrence of groundwater and groundwater movement.	3	U, R, Ap, An, E, C
CO 4	Acquire the necessary skills in the investigations and interpretation of surface and subsurface groundwater.	3, 6	U, R, C
CO 5	Evaluate and analyse various methods of groundwater recharge.	3, 6	U, R

Course Title: Geology Practicals – IV
Course Code: SGEO04PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Acquire basic concepts, know the nomenclature and understand various terms related to ore minerals; characterize the economically important metalliferous and non-metalliferous mineral deposits.	1, 6
CO 2	Understand the basic functions and principles of a petrological microscope and their effective use in mineral identification.	1
CO 3	Acquire the necessary skills for investigations and interpretation of surface and subsurface groundwater.	3, 6

Semester V

Course Title: Precambrian Geology of India
Course Code: SGEO0501

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Possess a basic understanding of geological setup of India and physiographic divisions of India.	1, 2	U, R, An
CO 2	Understand the structure and tectonics of Indian subcontinent using GoogleEarth and similar applications.	2, 4	U, Ap, An
CO 3	Develop concepts of formation of cratons, platforms and shields, and the geological processes responsible for these.	2	U, R, Ap, An, E, C
CO 4	Interpret geological maps and cross sections, and build geological history.	2	U, R, Ap, An, E, C
CO 5	Acquire a visual perspective about lithology, stratigraphy and its interpretation; acquire techniques and skills for fieldwork.	6, 3	U, Ap, An, E, C
CO 6	Be familiar with the concepts of radiometric dating, and determining the age of rocks.	2, 6	U, Ap, An, E, C

Course Title: Igneous Petrology
Course Code: SGEO0502

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Possess a basic understanding of the interior of Earth and common igneous rock nomenclature.	1	R, U
CO 2	Identify the common rock-forming minerals of igneous rocks in hand specimens and thin sections.	1, 6	U, Ap
CO 3	Identify various megascopic and microscopic textures and structures in laboratory as well as on the field, and understand their significance with regard to geological processes that have operated.	1, 6	R, U, An
CO 4	Assign names to igneous rocks based on their mineralogical and textural characteristics, and infer the processes or environment of their formation and tectonic associations.	1	U, Ap, An
CO 5	Understand the phase diagrams and basic experimental petrological studies to understand the crystallization and melting behaviour of minerals under various conditions; compare this with the magma formation under various tectonic set up.	1	U, An, E
CO 6	Sketch a petrographic thin-section; prepare a petrological report of a given igneous rock sample.	1, 6	An, C
CO 7	Use a petrological microscope; be familiar with the distribution of various igneous rocks in India.	1	U, Ap

Course Title: Structural Geology
Course Code: SGEO0503

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand stress, strain in three dimensions along with their mathematical expressions.	1, 2	U, R, Ap
CO 2	Know generation of deformation structures and describe them; identify and understand structures.	2, 3	U, R, Ap, An, E, C
CO 3	Create, solve and interpret structural maps and structural cross sections.	2, 6	U, R, Ap, An, E, C
CO 4	Represent structural data in mathematical form, and collect and use structural data in the field, constructions and the laboratory.	2, 6	U, R, Ap, An, E, C
CO 5	Understand relationship between tectonics, metamorphism and structures.	1, 2	U, R, Ap, An, E, C

Course Title: Metamorphic Petrology
Course Code: SGEO0504

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand basic processes and types of metamorphism.	1	U, R
CO 2	Identify various types of metamorphic rocks based on mineralogy and structures.	1, 6	U, R, Ap
CO 3	Understand concepts of metamorphic facies and protoliths.	1	U, R
CO 4	Understand and differentiate within various mineral assemblages; identify protoliths based on various textural and structural evidence.	1, 6	U, R, Ap, An
CO 5	Understand basic reaction mechanisms and thermodynamics of metamorphic reactions.	1	U, R, Ap, An
CO 6	Identify metamorphic rocks in hand specimens and under petrological microscope.	1, 6	U, R, Ap, An

Course Title: Geology Practicals – V
Course Code: SGEO05PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Use the basic skills acquired to interpret geological maps and cross sections in building the geological history; understand the geological history of India.	2
CO 2	Identify the common rock-forming minerals of igneous rocks in hand specimen and thin sections; sketch the petrographic thin-section and prepare a petrological report of a given igneous rock sample.	1
CO 3	Represent structural data in mathematical form; collect and use structural data in field, constructions and laboratory; understand and differentiate various mineral assemblages in metamorphic rocks and identify protoliths based on various textural and structural evidences.	1, 2, 6

Course Title: Remote Sensing and Image Interpretation
Course Code: SGEO05AC

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basic principles of remote sensing, the physics and optics of the data gathering, mechanisms, their evolution through history, their capabilities; know the development of Indian remote sensing satellites and systems.	4	U, R
CO 2	Utilise the basic principles of image interpretation for visually understanding and interpreting satellite imagery and topographical maps.	3, 4, 6	R, Ap
CO 3	Understand satellite data formats, their characteristics, their mode of acquisition; detect errors in satellite data and methods of correcting them.	4	U, Ap, E
CO 4	Understand and evaluate the various algorithms commonly used in computer processing of satellite data.	4	U, Ap, E
CO 5	Understand the application of image classification algorithms; create classified images for mapping of geological structures, Earth's surface features like vegetation, water bodies.	4, 6	U, Ap, An, C

Course Title: Applied Component Practicals – I
Course Code: SGEO05ACPR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Develop skills in understanding how the satellite image data are acquired and interpreted.	4
CO 2	Understand the application of image enhancement, manipulation and image classification algorithms to create classified images for mapping of geological structures, earth's surface features such as vegetation, water bodies, etc.	3, 4

Semester VI

Course Title: Phanerozoic Geology of India
Course Code: SGEO0601

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand evolution of life in Phanerzoic era and its effect on rock sequences in India.	1, 2	U, R, An
CO 2	Understand the interpretation of sedimentary rock sequences in terms of depositional environments.	2, 3	U, Ap, An
CO 3	Know stable isotopes and their application in sea-water and rock chemistry, hence palaeoclimate.	1, 2	U, R, Ap, An, E, C
CO 4	Understand structure and lithology of various sedimentary basins of India using Google earth and similar softwares.	2, 4, 6	U, Ap, An, E, C
CO 5	Visualize sedimentary and volcanic sequences; understand large igneous provinces in India and their impact on life.	1, 2	U, R, Ap, An, E, C
CO 6	Understand lithology, structure and economic mineralization including hydrocarbons in Maharashtra, in various rock units.	1, 2, 6	U, Ap, An, E, C

Course Title: Sedimentary Petrology
Course Code: SGEO0602

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Recall the concepts of weathering, erosion, sediment transport; and understand the effect of these processes in the formation of sedimentary rocks.	1	U, R, Ap
CO 2	Understand classification, nomenclature, importance and description of detrital, chemical and biogenic sedimentary rocks in thin sections and in the field.	1	U, Ap, An, E, C
CO 3	Understand, analyze and interpret sedimentary structures and textures; collect data about these.	1, 3, 6	U, R, Ap, An, E, C
CO 4	Identify and apply sediment source indicators such as heavy minerals to understand geochemistry of sedimentary rocks.	1, 6	U, R, Ap, An, E, C
CO 5	Interpret sedimentary rock succession to determine environment of deposition and paleoclimate.	1, 3	U, R, Ap, An, E, C

Course Title: Engineering Geology
Course Code: SGEO0603

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand various geological and engineering properties of rocks for its possible use in construction projects.	1	U, R
CO 2	Be familiar with various sources of rock materials and their geological properties; distinguish and select the type of material to be chosen for civil engineering projects.	1, 3	U, R, Ap
CO 3	Acquire the knowledge about various suitable and unsuitable geological conditions for different types of construction purposes.	1, 3, 6	U, R, Ap, An
CO 4	Analyse various known, well-studied failure cases of dams and bridges resulting due to problems arising from underestimation of structural-geological conditions.	1, 6	U, R, Ap, An

Course Title: Photogrammetry, Photo Interpretation and Fundamentals of GIS
Course Code: SGEO0604

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the meaning of the science of Photogrammetry, its evolution and applications in mapping for geological interpretation.	3, 4, 6	U, R
CO 2	Understand, analyse and evaluate the quality, distortions and errors in aerial photographs; understand the instruments used for aerial photo interpretation and correction.	4, 6	U, R, An
CO 3	Understand the aerial photo interpretation elements and apply them for interpretation and analysis of aerial photos; understand the processes of creating stereograms and create them; prepare a plan for aerial surveying.	4, 6	An, E, C
CO 4	Understand the basic concepts of GIS and apply them to create thematic maps; analyse various types of GIS data and evaluate the pros and cons of each.	4, 6	An, E, C

Course Title: Geology Practicals – VI
Course Code: SGEO06PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Understand interpretation of sedimentary rock sequences in terms of depositional environments, and of structure and lithology of various sedimentary basins of India using Google earth and similar softwares.	1, 2
CO 2	Understand, analyse and interpret sedimentary structures and textures; identify and apply sediment source indicators such as heavy minerals; understand geochemistry of sedimentary rocks.	2, 6
CO 3	Apply the knowledge of various sources of rock materials and their geological properties to distinguish and select the type of material to be chosen for civil engineering projects; utilize the basic concepts of GIS for creating thematic maps; analyse various types of GIS data and evaluate the pros and cons.	3, 4, 6

Course Title: Gemmology
Course Code: SGEO06AC

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know of the geological sources of gems, and their physical properties; understand the principles that are used in the physical testing of minerals/gemstones.	1, 5	U, R
CO 2	Understand the optical properties of the cut and polished gemstones; understand the nature of light and its properties in the identification of the stones.	5	U, Ap, An
CO 3	Identify gemstones using basic instruments; know the scientific operating principles of the instruments.	5, 6	U, Ap, An
CO 4	Understand the principle and nature of the stone when undertaking to cut and polish it, in order to maximize its beauty and value.	5, 6	U, E, An
CO 5	Know various coloured gemstones as well as diamonds, their simulants and the latest developments in the field; be familar with different types of weights and measures used in the gem and jewellery industry.	5, 6	U, An
CO 6	Understand in depth gemstone synthesis and various treatments used to enhance the beauty and value of the gems; know the manufacturing techniques used to produce these synthetic gems.	5	U, An

Course Title: Applied Component Practicals – II
Course Code: SGEO06ACPR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify various types of coloured gemstones.	5
CO 2	Use different types of basic instruments to identify cut and polished gemstones.	5, 6