



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

Programme: M.Sc. Geology

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

Sr. No.	On completing M.Sc. Geology, the student will be able to:
PSO 1	Acquire a fundamental understanding of geology, its applications in the fields of petrology, stratigraphy, geochemistry, palaeontology, structural geology, etc., and its linkages with related applied and interdisciplinary areas such as gemmology, hydrogeology, remote sensing, engineering geology, economic geology, geophysical prospecting, coal and petroleum geology, geography, environmental sciences, oceanography, physics, chemistry, mathematics, life sciences, atmospheric sciences, computer science and information technology.
PSO 2	Develop into professionals engaged in research and development, industry, teaching and government/public service.
PSO 3	Formulate geosciences-related problems; identify and apply appropriate geological principles and methodologies to solve a wide range of such problems; recognize the importance of remote sensing and geographic information system, mathematical modeling, simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.
PSO 4	Develop and acquire the relevant generic problem-solving skills and global competencies to solve various types of geoscience-related problems.
PSO 5	Acquire communication skills involving the ability to listen carefully, read texts and research papers analytically, including skills for independent investigation as well as team-work; imbibe a culture of research and innovation.
PSO 6	Develop and demonstrate professional behavior such as being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data, or committing plagiarism.



Course Outcomes (COs): M.Sc. Geology

Semester I

Course Title: Stratigraphy and Geology of India

Course Code: SGEO0701

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the evolution of the Indian continent in the Precambrian and Phanerozoic times.	1	U, An, Ap, R
CO 2	Develop the ability to read geological maps, satellite images in order to delineate various geological regions in India.	1, 2, 3	U, An, E, Ap, R
CO 3	Possess knowledge of economic mineral reserves in stratigraphic horizons.	1, 2, 4	U, R, An
CO 4	Recall and enhance the knowledge of evolution of life, atmosphere, hydrosphere and lithosphere through geological time.	1, 2	U, An, E, Ap, R, C
CO 5	Think and understand various processes operative through geological time, responsible for the present-day landscape of India; develop the ability to work in various stratigraphic terrains and identify rock sequences.	1, 4, 6	U, An, E, Ap,



Course Title: Geochemistry
Course Code: SGEO0702

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the basic concepts of geochemistry with reference to the periodic table of elements to understand the behaviour of major, minor, trace elements.	1	U, R, Ap, An
CO 2	Apply trace element geochemistry to understand development of various rock types in different rock tectonic settings; understand the working principles of some analytical instruments.	1, 3, 6	U, R
CO 3	Understand the basic concepts of fugacity and other thermodynamically important reactions, and the use of stable and radioactive isotopes in geological studies.	1, 3	U, R, Ap
CO 4	Use geochemical analyses to understand processes such as fractional crystallization, weathering, diagenesis, partial melting and P-T-t paths.	1, 3, 5	U, R, Ap, An
CO 5	Understand the use of oxygen isotopes in paleotemperatures of the oceans; analyse indicators of the global ice sheet changes and past ocean circulations.	1, 3, 5	U, R, Ap, An

Course Title: Structural Geology
Course Code: SGEO0703

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand stress, strain, their mathematical expression, and data collection for reconstruction of paleo-stress and deformation on macro to micro scale.	1, 2	R, U, Ap
CO 2	Know the concept of scale, homogeneity and isotropism; understand deformation textures on microscopic to regional scales, and differences in their interpretation.	1	U, Ap, An, C, E
CO 3	Know structural description, classification, data collection, data processing and analysis of folds, faults, joints, foliation and lineation; apply this knowledge in engineering projects.	1, 2, 4	U, An, Ap
CO 4	Carry out geological mapping in high-grade metamorphic or structurally complex terrain, read, interpret geological maps and restore cross sections; prepare mapping reports; be familiar with geometrical methods in structural geology.	1, 2, 4, 6	R, U, An, Ap, C, E,
CO 5	Possess advanced knowledge and understanding of plate tectonics, metamorphism and their relationship with structures and textures in deformed rocks.	1, 2	R, U, An, Ap, C, E,



Course Title: Advanced Gemmology
Course Code: SGEO0704

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the geological sources and regions in which the gem minerals occur; understand the principles of basic and advanced instrumentation techniques used in identifying the gemstones.	1, 2	U, E, An, Ap.
CO 2	Apply the knowledge of the properties of the coloured gemstones and diamonds to fashion it in the form of various cuts to improve its beauty in order to maximize its value.	2, 6	An, Ap, E, R
CO 3	Possess knowledge of the internal features of the gemstones and the various enhancement techniques in order to distinguish between the natural gemstones and their treated counterparts.	4, 5	U, An, E, Ap
CO 4	Understand the different methods for the treatment of gemstones to improve their appearance, and the methods for the creation of synthetic gemstones and their stimulants.	4, 5	U, Ap, An, E
CO 5	Apply knowledge of the physical, chemical, optical characteristics and diagnostic features including the enhancements to identify important inorganic and organic minerals/gemstones.	2, 6	U, Ap, R, E, An

Course Title: Stratigraphy and Geology of India
Course Code: SGEO0701PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Study geological maps to establish the geological sequence of the area in chronological order.	1, 4, 5
CO 2	Identify the important rock types, economic minerals, fossils and geomorphology of various stratigraphic horizons of India.	1, 2

Course Title: Geochemistry
Course Code: SGEO0702PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Understand use of geochemical analysis in interpretation of tectonic settings and paleo climate change using proxies.	1, 2
CO 2	Work with various rock types, understand advanced geochemical techniques and their applications in Earth science.	1, 2, 4



Course Title: Structural Geology
Course Code: SGEO0703PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Interpret cross sections of geological maps of complex structural areas and apply the methods of structural analysis in complicated terrains; understand relationship between tectonics and crustal deformation.	1, 2, 5
CO 2	Construct profiles and cross sections of geological maps showing various structural features: folds, faults, dykes, two series of dipping beds.	2, 4

Course Title: Advanced Gemology
Course Code: SGEO0704PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Appraise gemstones.	1, 2, 4
CO 2	Study growth features and inclusions of the gemstones in order to distinguish the natural gemstones from their synthetic counterparts.	1, 2



Semester II

Course Title: Remote Sensing and Digital Image Processing

Course Code: SGEO0801

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Know the basic aspects of remote sensing technology, its advantages, and fundamental physics behind the technology.	3	U, R
CO 2	Understand the importance of India's advancement in the technology of remote sensing, the capabilities of our own remote sensing satellites and their data characteristics, along with comparison with other international remote sensing programs.	1, 3, 6	U, R
CO 3	Apply the principles of image classification using visual as well as automated means.	1, 3	R, Ap
CO 4	Evaluate various domains in which remote sensing has been applied for societal good; Use the understanding for evaluation of an independent area from a geological point of view using digital data.	1, 3, 4	U, Ap, An, E
CO 5	Possess skill for independent analysis of satellite data; communicate procedures followed, with specific results and achievements.	1, 3, 5	Ap, An, E, C

Course Title: Igneous Petrology

Course Code: SGEO0802

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Recall the nomenclature of various igneous rocks based on mineralogical and textural characteristics; understand the systematic classification of common igneous rocks.	1, 2	U, R
CO 2	Possess enhanced skills in identification of variety of igneous rocks in hand specimens and thin-sections, and prepare of a petrological report.	2, 6	U, Ap, An, C
CO 3	Describe, evaluate and interpret the origin and evolution of igneous rocks using geochemical data.	1, 3, 4	U, E, C
CO 4	Understand the phase diagrams and their significance in interpreting the melting and crystallization of rocks.	2, 4	U, An, E
CO 5	Describe, evaluate and interpret the origin of magma in global geodynamic context.	1, 2	U, E, C
CO 6	Explain how magma is generated in the Earth's mantle and how magma typically evolves.	1, 2, 5	Ap, An, C



Course Title: Metamorphic Petrology
Course Code: SGEO0803

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the process of metamorphism and its various types with examples.	1	U, R
CO 2	Acquire knowledge about types of protoliths, metamorphic rocks and their classification in hand specimens, and under petrological microscope.	1, 2	U, Ap, An
CO 3	Know different types of textures and structures, and their use in interpretation of metamorphic history of rocks.	1, 2	Ap, An, E
CO 4	Understand the use of various chemographic projections, facies of metamorphism; understand the basic principles of thermodynamics such as entropy, enthalpy and Gibbs phase rule.	1, 3	R, U, An, Ap
CO 5	Comprehend metamorphism of mafic, pelitic and carbonate rock protoliths, and their mineral assemblage changes.	1, 2, 5	R, U, Ap, An
CO 6	Know granitoid- and charnockite-metamorphism and some other rare types of metamorphism.	1, 2	R, U, An

Course Title: Sedimentary Petrology
Course Code: SGEO0804

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand fluid dynamics, chemistry of weathering processes and its effect on sediment generation and transport.	1, 2	U, R, An
CO 2	Understand the concept of sedimentary facies and ability to recognise and delineate sediment facies in field.	1	U, An, Ap, E, C
CO 3	Possess advanced knowledge about continental and marine sedimentary environments and controlling factors.	1, 2	U, An, Ap, E, C, R
CO 4	Identify, describe and interpret textures and structures of sedimentary rocks in hand specimens and thin sections.	1, 4, 6	U, An, Ap, E, C, R
CO 5	Identify and interpret paleoclimate indicators and provenance indicators in sedimentary rocks; identify signatures of diagenesis.	1, 4	U, An, Ap, E, C, R



Course Title: Remote Sensing and Digital Image Processing
Course Code: SGEO0801PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Interpret satellite imagery for: land use/ land cover, geomorphology, geology and mapping the neighbourhood.	2, 3, 4
CO 2	Use digital image processing (using number matrix): enhancement, manipulation, classification; use QGIS for display of various types of image formats, pallets, display elements and for georeferencing.	2, 3, 4

Course Title: Igneous Petrology
Course Code: SGEO0802PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Use megascopic and microscopic features in identification of igneous rocks.	1, 2
CO 2	Apply CIPW normative calculation in the identification of igneous rocks.	1, 2

Course Title: Metamorphic Petrology
Course Code: SGEO0803PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Plot rock compositions on chemographic diagrams: ACF, AKF and AFM.	1, 2
CO 2	Identify hand specimen of metamorphic rocks through their megascopic and microscopic features of textures and structures; use the specimens in interpretation of metamorphic history of the rocks.	1, 2, 5



Course Title: Sedimentary Petrology
Course Code: SGEO0804PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify, describe and interpret textures and structures of sedimentary rocks in hand specimen and thin sections.	1, 2, 4
CO 2	Acquire and analyze paleocurrent, heavy mineral, grain size, and geochemical data from the sedimentary rocks.	1, 2



Semester III

Course Title: General and Invertebrate Paleontology

Course Code: SGEO0901

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Recall basics of palaeontology, definition, types of fossils, mode of preservation and fossilization conditions; Understand how fossils represent an incomplete record.	1	R, U
CO 2	Understand how organisms are distributed as per bathymetry; Know basics of systematic taxonomy, terminologies associated with kinds of specimens, evolution, evolutionary trends, types of evolution.	1, 2	U, R, Ap
CO 3	Know selected classes of fossils including morphological characters, evolutionary trends and geological history.	1, 2, 3	U, R, Ap, An, E
CO 4	Acquire knowledge related to paleoenvironmental studies.	3, 4	U, R, Ap
CO 5	Develop concept of paleobiogeography and plate tectonics with Indian examples.	4	U, R, Ap



Course Title: Hydrogeology
Course Code: SGEO0902

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the medium properties that control groundwater flow and transport, including porosity, hydraulic conductivity and other water-bearing properties of rocks.	1, 2	R, U
CO 2	Understand the essential components and function of the hydrologic cycle and the groundwater balance equation; know groundwater resource estimation.	1, 3	U, Ap, An, E
CO 3	Know systematic groundwater sample collection methods and well inventory to gather the information from wells, the topography of the ground; prepare a water table contour map.	2,3, 4	U, Ap, An, C
CO 4	Understand and interpret soil cross-sections, calculate the thickness of the unsaturated zone, and the rate of groundwater flow; deduce the direction in which groundwater is flowing and their implications to society.	4, 5	U, Ap, E
CO 5	Estimate the depth to the saline interface in a coastal and island hydrogeological framework; evaluate saltwater intrusion or related problems with systematic data collection; know various methods to mitigate this issue.	3, 4	Ap, An, E, C
CO 6	Apply remote sensing, geographical information systems and resistivity methods to identify groundwater prospective zones.	1, 3 5	Ap, An
CO 7	Know the effect of physical and chemical constituents affecting the quality of groundwater for domestic, industrial and agricultural use; interpret the data using software and graphical representations; estimate the suitability of groundwater for different use based on internationally recognized standards; and know the various measures to be adopted in case of contamination.	2, 4, 6	U, Ap, An
CO 8	Understand the groundwater reserves of India and their relationship with geological formations; know the best artificial recharge practices; identify suitable locations to build appropriate artificial recharge structures.	2, 3, 4	Ap, An, E, C



Course Title: Geophysical Prospecting
Course Code: SGEO0903

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand fundamental principles of geophysics, and their applications in mineral exploration.	1, 2	U, An, Ap, R, E
CO 2	Understand the principles and working of geophysical survey instruments as well as airborne surveys and their use in mineral exploration.	1, 4	U, An, Ap, C
CO 3	Understand the importance of geophysical exploration in petroleum and coal industry; and acquire the art of interpretation and processing the data.	1, 2, 4	U, An, Ap, E, C, R
CO 4	Be familiar with subsurface geophysical prospecting, radioactive, electrical and other types of logs, log interpretation and its application in petroleum industry.	1, 4	U, An, Ap, E, C, R
CO 5	Be acquainted with recent trends in surface as well as subsurface geophysical exploration.	4, 6	U, An, Ap

Course Title: Coal and Petroleum Geology
Course Code: SGEO0904

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand generation, migration and accumulation of hydrocarbons, traps, source rocks, reservoirs and cap rocks.	1, 4	R, U
CO 2	Understand diagenesis and coal formation, along with qualitative analysis of coal; know the applications of coal petrography.	1, 4	U, R, An, Ap
CO 3	Acquire knowledge about petroleum and coal reserves of India; understand coal mining and petroleum exploration.	1, 2, 9	U, R, An, Ap, C
CO 4	Know unconventional energy reserves such as CBM, shale gas and gas hydrates; and their importance in current global energy scenario.	1, 9	U, An, Ap
CO 5	Carry out detailed core logging, log interpretation and core analysis along with laboratory techniques.	9	U, An, Ap
CO 6	Acquire skills of reserve and resource estimation, construction of isopach, isolith and structure contour maps, and their application in oil industry.	1, 2, 9	U, R, An, Ap, C, E



Course Title: General and Invertebrate Paleontology
Course Code: SGEO0901PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify some important invertebrate fossils belonging to Brachiopoda, Bivalvia, Gastropoda, Ammonoidea, Trilobita, Echinoidea and corals using their morphological characters.	1, 2
CO 2	Understand some important ichnofossils.	1, 2

Course Title: Hydrogeology
Course Code: SGEO0902PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Prepare groundwater contour maps, flow nets; understand groundwater flow problems.	1, 2, 3
CO 2	Apply remote sensing and GIS in groundwater exploration and management.	1, 2, 3

Course Title: Geophysical Prospecting
Course Code: SGEO0903PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Be familiar with subsurface geophysical prospecting, radioactive, electrical and other types of logs, log interpretation and their application in petroleum industry.	1, 3
CO 2	Understand the acquisition, processing and interpretation of the geophysical data.	2, 3

Course Title: Coal and Petroleum Geology
Course Code: SGEO0904PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Carry out detailed core logging, log interpretation and core analysis.	2, 4
CO 2	Calculate reserve estimation with the help of numerical problems.	2, 4



Semester IV

Course Title: Micropalaeontology and Oceanography

Course Code: SGEO1001

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the relationship of micropaleontology with ocean sciences.	1,3	U, R, Ap
CO 2	Acquire modern field and laboratory techniques in the study of microfossils.	1, 3, 4	U, R, Ap, C
CO 3	Understand various types of microfossils, their classification, taxonomic identification, and application in paleoenvironment interpretation.	1, 2, 3	U, R, Ap, C
CO 4	Acquire knowledge related to history of development of oceanography, basic concepts in oceanography and scientific ocean drilling and its major accomplishments.	1, 2, 3	U, R, Ap,

Course Title: Engineering Geology

Course Code: SGEO1002

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Acquire knowledge about engineering properties of rocks and soils encountered during various civil engineering projects.	1, 2	U, R, Ap, An
CO 2	Understand various geological and geotechnical investigation of different project sites using boreholes, seismic /electric methods for bridges and pavements.	1, 2	U, R, Ap, An
CO 3	Know various terminologies and classification associated with tunnels, and constructions along the beach for various purposes.	1, 2	U, R, Ap, An
CO 4	Know about earthquakes and aseismic design for buildings; understand landslides and preventive measures.	2	U, Ap, An
CO 5	Understand various suitable and unsuitable geological and geotechnical conditions at the site of dams and reservoirs.	2, 6	U, Ap, An, E



Course Title: Economic Geology
Course Code: SGEO1003

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Understand the concept of ore-bearing fluids, their origin and migration and processes of formation of ore deposits.	1	U, R, Ap,
CO 2	Acquire knowledge related to controls of ore localization; ore deposits and plate tectonics.	1,2	U, R,Ap
CO 3	Know mineralogy, classification and genesis of ore deposits associated with igneous, sedimentary and metamorphic affiliations.	1, 4	U, R, Ap, An, E
CO 4	Know ore minerals related to the iron, manganese, base metals, chromium, gold, tin and tungsten with special reference to their mineralogy, genesis, specification, uses and distribution in india.	1, 2, 4	U, R, Ap, An, E
CO 5	Understand important Indian ore deposits with reference to their geology, stratigraphy and reserves; know a few case studies of occurrence of economic mineral deposits from provinces other than the Indian sub-continent.	1, 2, 4	U, R, Ap, An, E, C

Course Title: Dissertation
Course Code: SGEO1004

Sr. No.	On completing the course, the student will be able to:	PSOs addressed	Cognitive levels
CO 1	Identify key research questions on which to carry out independent research.	8, 9	U, R, Ap, An,
CO 2	Demonstrate appropriate referencing; and develop skills in other aspects of academic writing.	8, 9	U, R, Ap, An, E, C
CO 3	Understand and apply theoretical frameworks to the chosen area of study.	8, 9	U, R, Ap, An, E
CO 4	Develop and use written and oral presentation skills.	8, 9	U, R, Ap, An, E, C
CO 5	Carry out independent research in written format and report results and conclusions with reference to existing literature.	8, 9	U, R, Ap, An, E, C
CO 6	Analyse and synthesise research findings and demonstrate understanding of report writing.	8, 9	U, R, Ap, An, E, C



Course Title: Micropaleontology and Oceanography
Course Code: SGEO1001PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Use modern field and laboratory techniques in the study of microfossils.	1, 2
CO 2	Apply the quantitative study of planktic foraminifera in the interpretation of relation to paleoclimatology.	1, 2, 4

Course Title: Engineering Geology
Course Code: SGEO1002PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Apply various geological and geotechnical investigations for various civil engineering projects.	1, 2
CO 2	Understand modern techniques and their application in rock and soil mechanics; understand the effect of nature of rock/ soil on the construction; be familiar with the presentation of data obtained from geological mapping of construction site.	2, 5, 6

Course Title: Economic Geology
Course Code: SGEO1003PR

Sr. No.	On completing the course, the student will be able to:	PSOs addressed
CO 1	Identify important ore minerals in hand specimens; know ore microscopy - textures, microstructures, and the optical properties of ores.	1, 2, 4
CO 2	Understand the techniques of reserve and resource estimation, mine planning, report writing and detailed geological mapping in economic geology.	2, 4, 6