Mafatlal Gagalbhai Science Institute (Autonomous)
(M. G. Science Institute), Ahmedabad
Accredited "A" level by NAAC (3rd Cycle)

Managed by The Ahmedabad Education Society

Affiliated to
Gujarat University
(Recognized by University Grants Commission)

SYLLABUS
(Outcome Based Education Pattern)
for 3 years B. Sc. / 4 years B. Sc. (Honours) programme
for

B. Sc. SEMESTER - III
based on
National Education Policy (NEP) 2020

For Graduate Degree in

GEOLOGY
(Earth Sciences)
(In force from June, 2025)

Submitted by
Geology Department
M. G. Science Institute
Navrangpura
Ahmedabad – 380 009

PROGRAM SPECIFIC OUTCOMES (PSOs)

On completion of the course the learner will be able to

PSO 1: Academic skills:

(i) Comprehend various branches of Mineralogy in detail such as optical mineralogy and crystallography. Grasp the knowledge of petrology, economic geology, physical geology, global tectonics and hydrogeology.

(ii) Demonstrate the fundamental knowledge of the stratigraphy, palaeontology, structural geology, geomorphology and dynamics of the earth.

PSO 2: Laboratory skills:

Identification of minerals and rocks at megascopic and microscopic level. Study of crystal models with reference to forms. Modes of preservation of fossils and basic exercises of structural geology included.

PSO 3: Personal skills:

Express the basic concepts of the most important branches of the subject. Communication skills developed through the participation in various programmes related to the subject as well as during the data collection in the field work.

PSO 4: Social skills:

Social relevance of earth systems and processes related to other subjects.

M. G. Science Institute (Autonomous)
Design and Structure of Geology (Earth Sciences) UG Courses

Course Type/ Department	Semester	Course		Credit	Work Hours/ Week
		No.	Name		
Geology (Major)	III	GEM 231	Mineralogy, Petrology and Economic Geology	4	4
		GEM 232	Physical Geology, Hydrogeology, Stratigraphy and Structural Geology	4	4
		GEM 233 P	Mineralogy, Petrology and Structural Geology Laboratory	4	8

Compulsory field work in a suitable geological area to study the elementary aspects of field geology either in semester III.

COURSE OUTCOMES (COs):

On completion of the course, students will be able to

CO 1: Gain a better understanding of the various optical properties of minerals along with refractive index, and various forms and their combinations of crystals. Acquire the knowledge of most common rock types, their structures and importance.

CO 2: Analyze the mode of occurrence, origin, uses, and distribution of some economic minerals in India. Understanding the mother earth very well with reference to various processes operated within and on the surface of the earth.

CO 3: Basic concepts of stratigraphy and palaeontology will be applied. Gain the idea of most common structural features found in the rocks.

CO 4: Articulate the basic ideas of geomorphology, neotectonics and hydrogeology.

CO 5: Practically they will be able to identify various minerals and rocks as well as how to distinguish it from each other in hand specimens as well as under microscope.

CO 6: Identification of mineral crystals with reference to their forms and combinations.

CO 7: Recognize various modes of preservation of fossils. They will be able to construct map sections, outcrop filling problems and geometrical exercises.

CO 8: Field excursion will create the broad idea of any geological investigation with reference to rock types, structures, stratigraphy and economic importance.

B. Sc. Semester III

GEOLOGY - THEORY and PRACTICALS

Course-wise detail syllabus

GEM 231

Mineralogy, Petrology and Economic Geology

Unit	Course details
Unit –1	**Optical Mineralogy:** Passage of light through Nicol prism, R. I. of minerals, Beck's test and its effects. Twinkling, Pleochroism, Extinction. Elementary knowledge of interference colours and twinning.
Unit –2	**Crystallography:** Parameters, Axial ratio, Parameters system of Weiss and Miller Indices. Crystal systems: Cubic and Tetragonal - their study with examples in details.
Unit –3	**Petrology:** Modes of occurrence and structures of igneous rocks – detailed study. Sedimentary rocks**:** Structures and importance of sedimentary rocks. Metamorphic rocks**:** Structures and their importance.
Unit –4	**Economic Geology:** Introduction to common rock forming, ore forming and industrial minerals. Study of the following economic minerals with reference to India: Mica, Iron, Manganese-, Chromium-, Aluminium-ores and Diamond.

GEM 232

Physical Geology, Hydrogeology, Stratigraphy and Structural Geology

Unit	Course details
Unit –1	**Global Tectonics:** Isostasy, Continental drift, Plate tectonics, Mid-oceanic ridges, Sea-floor spreading, Island arcs and Palaeomagnetism.

Unit –2	**Physical Geology:** Seas and Oceans – Currents, waves and tides, hypsographic curve, marine erosion and deposition. **Hydrogeology:** Terminology, Ground water as a geological agent, springs, Hydrological cycle. Classification of subsurface water.
Unit –3	**Stratigraphy:** General principles and Laws of Stratigraphy, Terminology of stratigraphy. Geological Time scale – major divisions of earth's geologic history. Correlation and Homotaxis of strata. Lithostratigraphic, chronostratigraphic and biostratigraphic units. **Palaeontology:** Definition. Elementary ideas about origin of life, evolution, and fossil record. Systematic classification of organisms – their characters.
Unit –4	**Structural Geology**: Terminology, Elevation and relief, contours, outcrops, Dip & Strike. Maps, Scales – their representation on maps. Structures in rocks – primary and secondary. Inliers and Outliers. Unconformity and Overlap.

Reference Books:

1) Introduction to Physical Geology, A. K. Datta, Kalyani Publisher, New Delhi.
2) A Text Book of Geology, P. K. Mukerjee, World press.
3) A Text Book of Geology with Special Reference to India, G. B. Mahapatra.
4) General Geology, V. Radhakrishnan (1987), V.V.P. Publishers, Tuticorin.
5) Principles Physical Geology, Arthur Holmes (1978), ELBS.
6) Rutley's Elements of Mineralogy, H. H. Read, CBS publishers.
7) Introduction to Rock Forming Minerals, R. A. Deer, R. E. Howie and J. Zussman (1978), The English Language Book Society.
8) Elements of Optical Mineralogy, N. H. Winchel, A. N. Winchel (1968), Willey, Delhi.
9) The Principles of Petrology, G. W. Tyrell (1960), Asia Publishing House.
10) Mineral Economics, R. K. Sinha and N. L. Sharma (1981), Oxford IBH Publishers.
11) India's Mineral Resources, S. Krishnaswamy (1979), Oxford & IBH Co.
12) Invertebrate Palaeontology, H. Woods (1982), Cambridge University Press.
13) Structural Geology, M. P. Billings (1977), Prentice Hall.

GEM 233 P

Mineralogy, Petrology and Structural Geology Laboratory

Course details
Megascopic identification of following minerals: Bloodstone, Flint, Opal, Beryl, Fluorite, Halite, Talc, Asbestos, Apatite, Graphite, Calcite, Dolomite, Magnesite, Baryte, Gypsum. **Ores:** Limonite, Ilmenite, Siderite, Chalcopyrite, Malachyte. **Microscopic identification of following minerals:** Hornblende, Hypersthene, Augite, Olivine, Tourmaline, Calcite, Sphene, Garnet, Apatite. **Megascopic identification of following rocks:** Graphic Granite, Porphyritic Granite, Pegmatite, Obsidian, Pumice, Slate, Schist, Gneiss. **Crystallography:** Study of typical crystal models belonging to Cubic and Tetragonal systems with their forms and indices in details.
Structural Geology – Construction of topographic profile, geological cross sections of horizontal beds with igneous intrusions and simple geometrical exercises.

M. G. Science Institute (Autonomous)

Design and Structure of Geology (Earth Sciences) UG Courses

Course Type/ Department	Semester	Course		Credit	Work Hours/ Week
		No.	Name		
Geology - Multidisciplinary Course- (GEMDC)	III	GEMDC 234 T	Petrology, Stratigraphy and Palaeontology	2	2
		GEMDC 234 P	Mineralogy and Petrology Laboratory	2	4

COURSE OUTCOMES (COs):

On completion of the course, students will be able to

CO 1: Acquire the knowledge of most common rock types, their structures and importance.

CO 2: Articulate the basic concepts of stratigraphy and palaeontology.

CO 3: Apply the idea of Geological time scale with the age in million years.

CO 4: Practically they will be able to identify most common minerals, ores and rocks as well as how to distinguish it from each other in hand specimens.

B. Sc. Semester III

GEOLOGY - THEORY and PRACTICALS

Course-wise detail syllabus

GEMDC 234 T

Petrology, Stratigraphy and Palaeontology

Unit	Course details
Unit –1	**Petrology:** Mode of occurrence and structures of igneous rocks – detailed study. Sedimentary rocks**:** Structures and importance of sedimentary rocks. Metamorphic rocks**:** Structures and their importance.
Unit –2	**Stratigraphy:** General principles and Laws of stratigraphy, Terminology of stratigraphy. Geological Time scale – major divisions of earth's geologic history. Correlation and Homotaxis of strata. Lithostratigraphic, chronostratigraphic and biostratigraphic units. **Palaeontology:** Definition. Elementary ideas about origin of life, evolution, and fossil record. Systematic classification of organisms – their characters.

Reference Books:

1) Introduction to Physical Geology, A. K. Datta, Kalyani Publisher, New Delhi.
2) A Text Book of Geology, P. K. Mukerjee, World press.
3) A Text Book of Geology with Special Reference to India, G. B. Mahapatra.
4) The Principles of Petrology, G. W. Tyrell (1960), Asia Publishing House.
5) Invertebrate Palaeontology, H. Woods (1982), Cambridge University Press.

GEMDC 234 P

Mineralogy and Petrology Laboratory

Course details
Megascopic identification of following minerals: Bloodstone, Flint, Opal, Beryl, Fluorite, Halite, Talc, Asbestos, Apatite, Graphite, Calcite, Dolomite, Magnesite, Baryte, Gypsum. **Ores:** Limonite, Ilmenite, Siderite, Chalcopyrite, Malachyte. **Megascopic identification of following rocks:** Graphic Granite, Porphyritic Granite, Pegmatite, Obsidian, Pumice, Slate, Schist, Gneiss.

GUJARAT UNIVERSITY
Design and Structure of Geology (Earth Sciences) UG Courses

Course Type/ Department	Semester	Course		Credit	Work Hours/ Week
		No.	Name		
Geology Skill Enhancement Course (GESEC)	III	GESEC 236	Physical Geology	1	1
		GESEC 236 P	Physical Geology Laboratory	1	2

COURSE OUTCOMES:

On completion of the course, students should be able to

CO 1: Understand the mother earth very well with reference to various processes operated within and on the surface of the earth.

CO 2: Analyze the concept of engineering geology and hydrogeology.

CO 3: Practically they will be able to apply the plotting techniques on maps and geological time scale.

CO 4: Apply the hydrological properties of rocks like porosity, permeability, and specific yield along with watershed management.

B. Sc. Semester III

GEOLOGY - THEORY and PRACTICALS

Course-wise detail syllabus

GESEC 236

Physical Geology

Unit	Course details
Unit –1	Geochemical evolution of the earth. Coral reefs. Mountain building process. Age of the earth. Glaciation. Glacio-eustasy.

Reference Books:

1) Introduction to Physical Geology, A. K. Datta, Kalyani Publisher, New Delhi.
2) A Text Book of Geology, P. K. Mukerjee, World press.
3) A Text Book of Geology with Special Reference to India, G. B. Mahapatra.
4) General Geology, V. Radhakrishnan (1987), V.V.P. Publishers, Tuticorin.
5) Principles Physical Geology, Arthur Holmes (1978), ELBS.
6) Engineering and General Geology, Parbin Singh (1994), S.K. Kataria and Sons, Delhi.

GESEC 236 P

Physical Geology Laboratory

Course details
Plotting of Coral reefs, Tectonic mountains and Glaciers on the maps. Geological Time scale.