UNIVERSITY OF DELHI

DEPARTMENT OF GEOLOGY

COURSE NAME: Bachelor of Science in Geology (Hons)

(SEMESTER -I)

based on

Undergraduate Curriculum Framework 2022 (UGCF)

(Effective from Academic Year 2022-23)

University of Delhi

Course name: **Bachelor of Science in Geology (Hons): Sem 1**

Course Title	Nature of the Course	Total Credits	Components			Eligibility Criteria/ Prerequisite	**Contents of the course and reference is in**
			Lecture	Tutorial	Practical		
Earth System Science	DSC-1	4	3	0	1	Students of BSc. Hons Geology only	**Annexure-I**
Mineral Science	DSC-2	4	3	0	1	Students of BSc. Hons Geology only	**Annexure-II**
Concepts of Stratigraphy	DSC-3	4	3	0	1	Students of BSc. Hons Geology only	**Annexure-III**
Essentials of Geology	GE-1	4	4	0	0	Having passed CBSE 12th standard or equivalent examination	**Annexure-IV**

Semester I (22 Credits) DSC1 (4 Credits), DSC2 (4 Credits), DSC3 (4 Credits), GE1 (4 Credits), AEC1 (2 Credits), SEC1 (2 Credits), VAC1 (2 credits)
Discipline Specific Courses (DSCs)

12.1.1. Course code: DSC-1 (4 credits), Course Title Earth System Science, Total Credits 4, (L3, P1)

Objective Course

Introduction to the subject Geology. Holistic understanding of Earth as a planet in the Solar System and its relationships with other terrestrial planets. Understanding of the processes occurring in lithosphere, hydrosphere, biosphere, and atmosphere.

Learning Outcomes

After completion of this course, students will be able to understand and comprehend the connectivity and dynamics of the atmosphere, lithosphere, and hydrosphere of the Earth. A thorough understanding of Geology, its various branches and the overall scope of Earth Science will be possible through this course.

Unit 1

Holistic understanding of dynamic planet 'Earth' and its orbital parameters. Introduction to various branches of Earth Sciences. General characteristics and theories about the origin of the Universe including our Solar System and its planets. The terrestrial and Jovian planets. Interior of the Earth. Meteorites and Asteroids. Earth's origin, size, shape, mass, density, rotational and revolution parameters. Methods to determine age of the Earth. Earth's Magnetic Field and Palaeomagnetism. Applications of paleomagnetism.

Unit 2

Plate Tectonics: Concept of plate tectonics, sea-floor spreading and continental drift. Earthquake and earthquake belts; Volcanoes- types, products and distribution of volcanic belts.

Unit 3

Hydrosphere and Atmosphere: Layers of the Atmosphere. Various cells of the atmospheric circulation. World surface oceanic currents and their distribution. Earth's heat budget. Orogeny and epeirogeny. Major mountain belts of the world.

Unit 4

Understanding the past from geologic records; Nature of geologic records; Standard Geological time scale and introduction to the concept of time in geological studies; Introduction to geochronological methods and their application in geological studies. History of development in concepts of uniformitarianism, catastrophism, and Neptunism, Physiographic divisions of India.

Practical:

- Study of major geomorphic features and their relationships with outcrops through
- physiographic models.
- Detailed study of topographic sheets and preparation of physiographic description of

- an area
- Study of distribution of major dams on map of India and their impact on river systems
- Study of major ocean currents of the World
- Study of different rock types
- Study of fossils and their application
- Study of physiographic map of earth during different Geological ages

Suggested Readings:

- Physical Geology, 15th Edition, Charles C. Plummer, Diane H. Carlson, Lisa Hammersley McGraw-Hill Education- 2016
- Essentials of Geology, 13th Edition Frederick K. Lutgens, Edward J. Tarbuck, Dennis G. Tasa- Pearson Publications 2016
- Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.
- Gross, M. G. (1977). Oceanography: A view of the earth.
- Duff, P. M. D. & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis.

12.1.2. Course Code DSC-2, Course Title: Mineral Science, Total Credits 4, (L3, P1)

Objectives

Major objectives for this course are to understand:
(1) the characteristics of major mineral groups in hand specimen and thin section
(2) phase equilibria, formation environments and associations of rock-forming minerals
(3) crystal symmetry, crystallography, and atomic structure

Learning Outcomes

At the end of this course, you will be able to:
(1) identify common rock-forming minerals in hand specimens and in thin sections using diagnostic physical, optical, and chemical properties.
(2) infer something about the formation environment of a silicate mineral using only its formula
(3) read a phase diagram
(4) predict the physical properties of a substance from its symmetry content
(5) plot crystal faces on a stereo projection

SYLLABUS

Unit 1: Chemical and Physical Fundamentals

- Importance of minerals, the definition of a mineral, atoms, ions, periodic table, bonding in minerals, compositional variations in minerals. (**4 lectures and 1 lab**)
- crystallization, crystal imperfections (defects, zoning, twinning), crystal precipitation, mineral classification schemes, and physical properties of minerals (appearance, crystal shape, strength, density, magnetism, reaction with acid). (**3 lectures and 1 lab**)
- polarized light, refractive index, uniaxial and biaxial indicatrixes, interference figures. (**4 lectures and 2 labs**)

Unit 2: Rock-forming minerals

- Igneous minerals (silicates), phase relations (**5 lectures and 2 labs**)
- Sedimentary minerals (zeolites, clays, sulfates, halides, oxides, carbonates), weathering processes. (**5 lectures and 2 labs**)
- •: Metamorphic minerals, textures, reactions, phase equilibria. (**4 lectures and 1 lab**)
- •: Economic minerals (magmatic, hydrothermal, and sedimentary ores; native metals, sulfides and sulfosalts, oxides and hydroxides, gemstones) (**4 lectures and 1 lab**)

Unit 3: Symmetry, Crystallography, and Atomic Structure

- Symmetry, stereo diagrams, forms and crystal morphology. (**3 lectures and 2 labs**)
- Unit cells and lattices in two dimensions and three dimensions, Bravais lattices, unit cell symmetry and crystal symmetry, crystal structures, crystal habit and crystal faces. (**4 lectures and 1 lab**)
- Ionic radii, coordination number, packing, Pauling's rules, silicate structures, substitutions, structures of non-silicates. (**3 lectures and 1 lab**)

Practicals

1. Study of physical properties of minerals in hand specimen

   Silicates: Olivine, Garnet, Kyanite, Staurolite, Tourmaline, Serpentine, Talc, Muscovite, Biotite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite.

   Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rosequartz, Smoky quartz, Rock crystal.

   Native Metals/non-metals, Sulfides, Oxides-Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite

   Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite.
2. Study of some key silicate minerals under an optical microscope and their characteristic properties.
3. Mineral stochiometry related numerical.
4. Numericals related to parameters and indices of crystals faces.
5. Stereographic projection of crystal faces.

Suggested Readings

1. Cornelis Klein and Barbara Dutrow, The manual of Mineral Science, Wiley Publication 2007
2. Nesse W. D., Introduction to Optical mineralogy.2008, Oxford University Press.
3. Deer W. A., Howie.R. A. and Zussman, J., An introduction to the rock-forming minerals 1992

12. 1.3. Course Code DSC-3, Course Title: Concepts of Stratigraphy Total Credits 4, (L3, P1)

Objectives
This is to introduce students with the fundamental concepts of stacking of sediments in both space and time based on principles of stratigraphy and sedimentation.

Learning Outcome:
Students will be able to learn the distribution of sedimentary rocks in both space and time and appreciate the stacking of sediments following the fundamental concepts of stratigraphy.

Unit 1:
Principles of stratigraphy, geological time scale

Unit 2:
Stratigraphic units: lithostratigraphic, chronostratigraphic and biostratigraphic units

Unit 3:
Stratigraphic classification and correlation. Methods of collecting stratigraphic data, identification of stratigraphic contacts and unconformities.

Unit 4:
Facies concept in stratigraphy. Applications of lithostratigraphy

Unit 5:
Fossils and stratigraphy; Evolutionary trends, Biozones and zone fossils

Unit 6:
Biostratigraphy in relation to other stratigraphic techniques

Unit 7:
Radiometric dating (K-Ar, Rb-Sr, U-Pb) and correlation techniques

Unit 8:
Basic principles of magnetostratigraphy, seismic stratigraphy and sequence stratigraphy.

Unit 9:
Concept of Stratotypes. Global Stratotype Section and Point (GSSP).
International and Indian code for stratigraphic classification.

Practical:
Preparation and study of stratigraphic maps:
(a) Correlation diagrams using lithologs of fossiliferous and nonfossiliferous stratigraphic units. Geophysical logs.
(b) Examination of isopach and isofacies maps.
(c) Exercises related to stratigraphic classification and correlation.

Suggested Readings:
1. Blatt, H., Berry, W.B. and Brande, S., 1991. Principles of stratigraphic analysis. Blackwell scientific publications, Oxford

2. Nicols G., 2009 Sedimentology and Stratigraphy 2nd Edition, Wiley-Blackwell
3. Brookfield, M.E., 2016 Principles of stratigraphy, Wiley India

GE-1 (4) One from GE Pool:

12.4.1 Course code: GE1, Course title: Essentials of Geology (L4, P0)

Objectives
1. Interactive and interdisciplinary nature of geology
2. Interplanetary scope of geology
3. Introduction to atmosphere, hydrosphere, biosphere and lithosphere

Learning Outcomes
1. Earth, its origin and concept of geological time
2. Formation of planets and solar system
3. Composition of inner as well as surficial components of planet earth
4. Major geomorphic features, and compositions of various parts of earth and major earth processes
5. Earth Resources

Unit 1
Introduction to geology, scope, sub-disciplines and relationship with other branches of sciences
Solar system and its origin: Terrestrial and Jovian planets; Nebular hypothesis.
Earth's size, shape, mass, density, rotational and evolutional parameters
Earth in comparison to other bodies in the solar system

Unit 2
Internal constitution of the earth - core, mantle and crust (Chemical and mechanical differentiation)
Convections in the earth's core and production of magnetic field;
Concept of Plate Tectonics as a unifying theory

Unit 3
Origin and composition of hydrosphere and atmosphere;
Origin of biosphere;
Origin of oceans, continents and mountains.

Unit 4
Geological Time Scale
Radioactivity dating and its application in determining the age of the rocks.
Earth Resources and their sustainable use

Suggested readings:
1. Holmes, A. (1992). Principles of Physical Geology, 1992, Chapman and Hall.
2. Emiliani, C. (1992). Planet Earth, Cosmology, Geology and the Evolution of Life and