DEPARTMENT OF GEOLOGY

BSC (Hons.) Geology
Category-I

DISCIPLINE SPECIFIC CORE COURSE – 1 (DSC-1) Earth System Science

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Earth System Science	**4**	**3**	**0**	**1**	**B.Sc. Hons. Geology students only**	**NIL**

Learning Objectives

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.

SYLLABUS OF DSC-1

Unit 1: **(12 Hours)**

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: **(9 Hours)**

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: **(9 Hours)**

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: (15 Hours)

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 (30 Hours)

1. Study of major geomorphic features and their relationships with outcrops through physiographic models.
2. Detailed study of topographic sheets and preparation of physiographic description of an area
3. Study of distribution of major dams on map of India and their impact on river systems
4. Study of major ocean currents of the World
5. Study of different rock types
6. Study of fossils and their application
7. Study of physiographic map of earth during different Geological ages

Essential readings

- Cesare Emiliani,1992; Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment
- Arthur Holmes, 197; Holmes Principles Of Physical Geology, by John Wiley & Sons

Suggestive readings (if any)

- 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.

DISCIPLINE SPECIFIC CORE COURSE – 2 (DSC-2) : Mineral Science

Credit distribution, Eligibility and Prerequisites of the Course

Course t itle & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite o f the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Mineral Science	**4**	**3**	**0**	**1**	**B.Sc. Hons. Geology students only**	**NIL**

Learning 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 OF DSC- 2

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. **(6 Hours)**
- 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). **(6 Hours)**
- Polarized light, refractive index, uniaxial and biaxial indicatrixes, interference figures. **(3 Hours)**

Unit 2: Rock-forming minerals

- Igneous minerals (silicates), phase relations **(6 Hours)**
- Sedimentary minerals (zeolites, clays, sulfates, halides, oxides, carbonates), weathering processes. **(6 Hours)**
- Metamorphic minerals, textures, reactions, phase equilibria. **(3 Hours)**

- Economic minerals (magmatic, hydrothermal, and sedimentary ores; native metals, sulfides and sulfosalts, oxides and hydroxides, gemstones) (**3 Hours)**

Unit 3: Symmetry, Crystallography, and Atomic Structure

- Symmetry, stereo diagrams, forms and crystal morphology. **(3 Hours)**

- 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. **(6 Hours)**
- Ionic radii, coordination number, packing, Pauling's rules, silicate structures, substitutions, structures of non-silicates. **(3 Hours)**

Practical:

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.

Essential readings

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

Suggestive 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

DISCIPLINE SPECIFIC CORE COURSE– 3 (DSC-3) Concepts of Stratigraphy

Credit distribution, Eligibility and Pre-requisites of the Course

Course t itle & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of t he course(if any)
		Lecture	Tutorial	Practical/ Practice		
Concepts of Stratigraphy	4	3	0	1	B.Sc. Hons. Geology students only	NIL

Learning 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 outcomes
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

SYLLABUS OF DSC-3

Unit 1: Principles of stratigraphy, geological time scale **(3 Hours)**

Unit 2 : Stratigraphic units: lithostratigraphic, chronostratigraphic and biostratigraphic units **(2 weeks)**

Unit 3 : Stratigraphic classification and correlation. Methods of collecting stratigraphic data, identification of stratigraphic contacts and unconformities. **(6 Hours)**

Unit 4: Facies concept in stratigraphy. Applications of lithostratigraphy **(3 Hours)**

Unit 5: Fossils and stratigraphy; Evolutionary trends, Biozones and zone fossils **(3 Hours)**

Unit 6: Biostratigraphy in relation to other stratigraphic techniques **(6 Hours)**

Unit 7: Radiometric dating (K-Ar, Rb-Sr, U-Pb) and correlation techniques **(6 Hours)**

Unit 8 : Basic principles of magnetostratigraphy, seismic stratigraphy and sequence stratigraphy. **(6 Hours)**

Unit 9 : Concept of Stratotypes. Global Stratotype Section and Point (GSSP). International and Indian code for stratigraphic classification. **(6 Hours)**

Practical (30 Hours)
Preparation and study of stratigraphic maps:

a) Correlation diagrams using lithologs of fossiliferous and non-fossiliferous stratigraphic units. Geophysical logs.
b) Examination of isopach and isofacies maps.

c) Exercises related to stratigraphic classification and correlation.

Essential readings

- Blatt, H., Berry, W.B. and Brande, S., 1991. Principles of stratigraphic analysis. Blackwell scientific publications, Oxford
- Nicols G., 2009 Sedimentology and Stratigraphy 2nd Edition, Wiley-Blackwell
- Brookfield, M.E., 2016 Principles of stratigraphy, Wiley India

Suggestive readings

1. Blatt, H., Berry, W.B. and Brande, S., 1991. Principles of stratigraphic analysis. Blackwell scientific publications, Oxford Annexure-III Page 24 of 25
2. Nicols G., 2009 Sedimentology and Stratigraphy 2nd Edition, Wiley-Blackwell
3. Brookfield, M.E., 2016 Principles of stratigraphy, Wiley India

COMMON POOL OF GENERIC ELECTIVES (GE) COURSES

Offered by Department of Geology

Category-IV

GENERIC ELECTIVES (GE-1): Essentials of Geology

Credit distribution, Eligibility and Pre-requisites of the Course

Course t itle & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of t he course
		Lecture	Tutorial	Practical/ Practice		
Essentials of Geology	**4**	**4**	**0**	**0**	**12th Pass**	**Nil**

Learning 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

SYLLABUS OF GE-1

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. **(16 Hours)**

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. **(16 Hours)**

Unit 3: Origin and composition of hydrosphere and atmosphere; Origin of biosphere; Origin of oceans, continents and mountains. **(12 Hours)**

Unit 4: Geological Time Scale Radioactivity dating and its application in determining the age of the rocks. Earth Resources and their sustainable use. **(16 Hours)**

Essential readings

- Holmes, A. (1992). Principles of Physical Geology, 1992, Chapman and Hall.
- Emiliani, C. (1992). Planet Earth, Cosmology, Geology and the Evolution of Life and
- Environment, Cambridge University Press.

Suggestive 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 Annexure-IV Page 25 of 25 Environment, Cambridge University Press.
3. Gross, M.G. (1977). Oceanography: A view of the Earth, Prentice Hall.
4. Grotzinger, J.P. & Jordan, T.H. (2020) Understanding Earth. 8th Edition, W.H. Freeman and Company