

# Department of Geology



## Cotton University, Guwahati

### **B.Sc. FIRST SEMESTER SYLLABUS**

PAPER: GLY24C101    Fundamentals of Geology - I    L+T+P=4+0+0= 4 credits

PAPER: GLY24M101    Fundamentals of Geology - I    L+T+P=4+0+0= 4 credits

PAPER: GLY24MDE101    The Dynamic Earth    L+T+P=3+0+0=3 credits

### **DETAILED SYLLABUS (MAJOR & MINOR)**

PAPER: GLY24C101    **Fundamentals of Geology - I**    L+T+P=4+0+0= 4 credits

PAPER: GLY24M101    **Fundamentals of Geology - I**    L+T+P=4+0+0= 4 credits

Total Number of Theory Classes (*Lectures*): 60 (60 hours)

#### **(i) Course learning outcome**

Students will get an opportunity to have a brief overview of the subject Geology. After studying this course, the student will be able to understand:

**CO1** Basic concepts of Physical Geology and Geomorphology

**CO2** Basic concepts of Crystallography and Crystal Chemistry.

**CO3** Basic concepts of Rocks and Minerals.

#### **(ii) Broad contents of the course**

The paper presents the fundamental concepts of the different branches of geology. It includes the origin and interior of earth as well as the endogenic and exogenic processes which are operative to create its different landforms. Basic concepts of crystallography, crystal chemistry and mineralogy are included in separate units. Having knowledge on this course, students will have clear idea about the different rock types.

#### **(iii) Skills to be learned**

Students will learn to identify and describe different landforms, crystals of different systems, minerals as well as different rock types.

#### (iv) The detail contents of this course

#### **THEORY**

**Unit 1: General Geology and Geomorphology:** Geology and its scope; Concept of Geologic Time, The Earth System- Rock cycle; Origin of Earth, Interior of Earth, Theory of Plate Tectonics, Endogenic and Exogenic processes of Earth. (8)

**Unit 2: Crystallography:** Definition, properties and examples of crystalline and amorphous substances; Crystallization and crystal growth, Classification of crystal. (8)

**Unit 3: Crystal Chemistry:** Ionic properties- chemical bond, ionic size and charge; Electronegativity; Ionization potential; Elementary concepts of isomorphism; Atomic substitution; Polymorphism; Solid solution; Exsolution; Packing and density; Radius ratio and coordination number; Pauling's rule. (8)

**Unit 4: Mineralogy:** Scope of Mineralogy; Definition of mineral; Mineral Classification; Physical properties of mineral; Relationship of physical properties with atomic structure; Crystal defects – point, linear, planar and bulk defects; Scope and utility of optical mineralogy; Optical properties of mineral. (9)

#### **Unit 5: Petrology**

**Igneous Petrology:** Origin of igneous rocks; Magma: definition, composition, physical properties, origin and types; Crystallization of magma; Magmatic differentiation and assimilation; Mode of occurrence of igneous rocks; Textures & structures of igneous rocks; Classification of igneous rocks. (9)

**Sedimentary Petrology:** Scope and nature of sedimentary rocks; Sedimentary cycle; Processes of formation of sedimentary rocks: Weathering, erosion, transportation, deposition and diagenesis; Mineralogical composition of sedimentary rocks; Preliminary idea of sedimentary texture and structure. (9)

**Metamorphic Petrology:** nature of metamorphic rocks; Metamorphism: Agents of metamorphism, Types of metamorphism; Types of protoliths; A preliminary classification of metamorphic rocks; Concept of zones, grades and facies. (9)

#### **Recommended Books:**

1. Essentials of Geology- Frederick K. Lutgens, Edward J. Tarbuck and Dennis Tasa, *Prentice Hall*.
2. Physical Geology – R. F. Flint and J Skinner, *John Wiley and Sons, Inc*
3. Textbook of Physical Geology- G. B. Mahapatra, *CBS Publishers*.
4. Manual of Mineralogy (After J.D. Dana) – C. Klein and C.S. Hurlbut, Jr.; *John Wiley and Sons, Inc*.
5. Mineralogy – Dexter Perkins; *PHI Learning Pvt. Ltd*.
6. An Introduction to Crystal Chemistry – R.C. Evans; *Cambridge Univ. Press*.
7. Introduction to Mineral Sciences – A. Putins; *Cambridge Univ. Press*.
8. Optical Mineralogy – P.F.Kerr; *McGraw-Hill Book Company, INC*.
9. Principles of igneous and metamorphic petrology- A. Philpotts & J. Ague; *Cambridge University Press*.
10. Principles of igneous and metamorphic petrology- J. D. Winter; *Pearson*.
11. Introduction to Sedimentology by S. M. Sengupta; *CBS Publisher & Distributors*.

## **DETAILED SYLLABUS (MDE)**

**PAPER: GLY24MDE101**

**The Dynamic Earth**

**L+T+P=3+0+0=3 credits**

Total Number of Theory Classes (*Lectures*): 45 (45 hours)

### **(i) Course learning outcome**

This course offers a concise and focused idea of the position and uniqueness of the blue Earth in the universe. After completion of the course, the students will be able to:

**CO-1** Understand the structure and evolution of the planetary bodies.

**CO-2** Understand the specific conditions and systems that allow lives to sustain in the Earth.

**CO-3** Explain the key macro-components of the planet.

**CO-4** Understand the plate tectonic process and its role in governing different process due to the movement of tectonic plates.

### **(ii) Broad contents of the course**

The course provides the evolution of the key objects in the universe, with a focus on describing the details about the solar system. It will offer a preliminary knowledge of the dynamic nature of the Earth and how it works to make it the only habitable planet known till date. It will finally provide a detail layout of the core principle and ideas of the modern plate tectonic theory, its evidences and shaping the planet as we can see it.

### **(iii) Skills to be learned**

This course is designed to teach to the learners about the celestial bodies that make the universe and how they evolve. Learners will have an opportunity to be educated with the new scientific ideas that explains the formation and continuous progression of the planet Earth. They will learn the physics of the different processes that shapes the planet due to the specific energy distribution within it that leads to large scale adjustment of the planetary building blocks, often triggering earthquakes, tsunamis, volcanoes in a short time scale and forming mountains and oceans over a longer period of times.

### **Detail contents of this course:**

#### **THEORY**

##### **Unit 1: Basic concept of planetary systems (9 Lectures)**

The structure and evolution; Origin of the universe; Asteroid and comet; Sun - How it works and its anatomy; Origin of the planets; The solar system; Earth vs other planets; Earth – concept of Geologic time; Geomaterials-Rock forming minerals and rocks.

##### **Unit 2: The Earth's systems (9 Lectures)**

Gravity and isostasy; Concept of system; Hydrologic systems (River, glacial, groundwater, shoreline); Tectonic Systems; Continents and oceans – Composition, formation and major structural features; Weathering – Different types and rates, product of weathering

##### **Unit 3: Earth's internal structure (9 Lectures)**

History and models of Earth's interior; the layered structure of the Earth; Composition and physical properties of the different units; Crust, mantle and core- their working principle & relevance in the planetary system.

**Unit 4: The unified theories of plate tectonics (9 Lectures)**

Continental drift hypothesis – its evidence and drawbacks; Development of the modern concept of plate tectonics; Plate movement, sea floor spreading, plate boundaries, mantle plumes and hotspot; Geomagnetism.

**Unit 5: Major consequences of the dynamic nature of plates (9 Lectures)**

Mountain building process; Volcanism; Earthquakes- mechanism, predictive models; Tsunami – Tsunami waves and their generation, effects, prediction and monitoring

***Recommended Books:***

1. Skinner, B.J., Porter, S.C., Park, J.J. Levin, H.L., 2004. *Dynamic Earth: An introduction to physical geology*.
2. Duff, P.M.D. and Duff, D. eds., 1993. *Holmes' principles of physical geology*. Taylor & Francis.
3. Skinner, B. and Porter, S., 1987. *Physical geology*.
4. Siddhartha, K. *The Earth's Dynamic Surface*.
5. Hamblin, W.K., 1994. *Introduction to physical geology*.
6. Hamblin, W.K., Christiansen, E.H. *Earth's Dynamic Surface*.
7. Press, F., 2004. *Understanding earth*. Macmillan.
8. Bloom, A.L., 1998. *Geomorphology: a systematic analysis of late Cenozoic landforms*.

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