

Department of Geology



Cotton University, Guwahati

B.Sc. THIRD SEMESTER SYLLABUS

PAPER: GLY24C301	Physical Geology	L+T+P=3+0+1= 4 credits
PAPER: GLY24C302	Crystallography	L+T+P=3+0+1= 4 credits
PAPER: GLY24M301	Physical Geology	L+T+P=3+0+1= 4 credits
PAPER: GLY24MDE301	The Dynamic Earth	L+T+P=3+0+0=3 credits

DETAILED SYLLABUS (CORE/MAJOR)

PAPER: GLY24C301	Physical Geology	L+T+P=3+0+1= 4 credits
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Total Number of Theory Classes (*Lectures*): 45 (45 hours)

Total Number of Practical Classes (*Practical*): 15 (30 hours)

(i) Course learning outcome

After studying this course, the student will be able to:

CO1 Know about interior of the earth.

CO2 Have the concept of continental drift, plate tectonics.

CO3 Know about weathering and types of weathering, mass wasting and types of mass wasting.

CO4 Know about the continents and ocean basins and their evolution.

CO5 Know about volcanoes, the different aspects of earthquake and earthquake zones in India.

CO6 Know about drainage basins and types of drainage basins.

CO7 Understand geomorphic processes and the resulting common landforms.

(ii) Broad content of the course: The paper presents about interior of the earth, Continental drift, Plate tectonics, mass wasting and types of mass wasting, continents and ocean basins, volcanoes, earthquake, Drainage basins and types of drainage basins, Geomorphic processes and common landforms.

(iii) Skills to be learned: Students will learn to identify, describe and classify landforms. The students will also acquire skills to study and interpret topographic maps, geomorphic models.

Detail contents of this course:

THEORY

Unit 1: Understanding the Earth through seismology (2), Temperature of the Earth's interior (2). Continental Drift, Plate tectonics (4). Weathering - Physical weathering, Chemical Weathering, Biological Weathering, Products of weathering (3), Mass wasting, factors that control slope stability (3), Classification of mass wasting (3)

Unit 2: Major surface features of the earth – continents and ocean basins and their evolution (3), Major internal processes of the earth- Volcanism and volcanoes (3), Types and distribution of volcanoes (2), Earthquake and its causes, Earthquake belts, Earthquake zones of India (5).

Unit 3: Glacial and periglacial processes and landforms (2), Fluvial processes and landforms (3), Drainage and its types (2), Concept of drainage basin (2), Aeolian Processes and landforms (2), Coastal Processes and landforms (2), Landforms associated with igneous activities (2).

PRACTICAL

Study of contours: Pattern of contours to indicate various topographical features (2); Interpretation of topographic maps (5); Drawing of profile and study of geomorphological features from topographic maps (6). Model study of different geomorphic features (2).

Recommended Books:

1. Geomorphology – A.L. Bloom; Prentice Hall of India Pvt. Ltd.
2. A Textbook of Geomorphology – P. Dayal; Shukla Book Depot, Patna. 23
3. Essentials of Geology- Frederick K. Lutgens, Edward J. Tarbuck and Dennis Tasa, Prentice Hall.
4. Geomorphology – S. Singh; Prayag Pustak Bhawan, Allahabad.
5. Physical Geology – R. F. Flint and J Skinner, John Wiley and Sons, Inc.
6. Textbook of Physical Geology- G. B. Mahapatra, CBS Publishers.
7. Principles of Geomorphology – W. D. Thornbury; John Wiley and Sons, Inc.
8. Engineering and General Geology – P. Singh (6th edition); S. K. Kataria and Sons.

PAPER: GLY24C302 Crystallography L+T+P=3+0+1= 4 credits

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

Total Number of Practical Classes (*Practical*): 15 (30 hours)

(i) Course learning outcome

Studying the basics of crystallography helps in understanding and building the overall knowledge in Geology specially the branch of mineralogy.

(ii) Broad contents of the course

The course deals with the study of crystals with respect to their morphology, and symmetry of the crystal classes as well as internal structure of the crystal.

(iii) Skills to be learned

The students will be familiarizing themselves with crystal morphological features, symmetry and forms as well as the internal structure of the crystal. They will be able to do the projection of crystal faces and determination of axial ratio.

Detail contents of this course

THEORY

Unit 1: Crystal morphology – faces, edges and solid angle; Interfacial angle and its measurement; Symmetry operations and elements; Types of external symmetry shown by the crystals; Point Groups; Symmetry notations of Hermann-Mauguin with relation to different crystal systems and conversion to total symmetry. (10)

Unit 2: Crystallographic axis; Axial ratio and its determination; Parameters and indices; Crystal forms and habit; Zone, Zone axis and Zonal equation. (6)

Unit 3: Unit cell; Definition and types of lattices; Significance of the lattice; Bravais (Space) lattices; Skew axis and Glide planes; Space Groups. (7) 24

Unit 4: Study of 32 Point Groups (Crystal classes) including forms, symmetry elements, stereogram and example of minerals. (7)

Unit 5: Crystal intergrowth; Definition of twinning, Twin elements, Composition surface, Types of Twinning, Origin of twinning, Twin laws, Study of twin laws of minerals in different crystal systems. (10)

Unit 6: Concept of spherical and stereographic projection. (5)

PRACTICAL

Study of the forms and symmetry elements of crystals belonging to the holohedral (Normal) classes of Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic & Triclinic systems and Hextetrahedral, Diploidal, Gyroidal, Tetragonal-scalenohedral, Hexagonal-Trapezohedral, Hexagonal-scalenohedral & Trigonal-trapezohedral classes with the help of either natural crystals or wooden and glass models; Drawing of crystals in clinographic projections (7)

Study of twinning with the help of crystal models with reference to composition plane, twin plane and twin axis. (3)

Stereographic projection and determination of axial ratios of crystal models of the holohedral classes of Isometric, Tetragonal, Orthorhombic and Monoclinic systems. (5)

Recommended Books:

1. Manual of Mineralogy (After J.D. Dana) – C. Klein and C.S. Hurlbut, Jr.; *John Wiley and Sons, Inc.*
2. Mineralogy – Dexter Perkins; *PHI Learning Pvt. Ltd.*
3. Mineralogy – L.G. Berry and B. Mason (Revised by R.V. Dietrich); *CBS Publishers and Distributors.*
4. A Textbook of Mineralogy – E.S. Dana (Revised by W.E. Ford); *New Age International Publishers.*
5. Mineral Science – K. Conelis; *John Wiley & Sons, Inc.*
6. An Introduction to Crystal Chemistry – R.C. Evans; *Cambridge Univ. Press.*
7. Introduction to Mineral Sciences – A. Putins; *Cambridge Univ. Press.*

DETAILED SYLLABUS (MINOR)

PAPER: GLY24M301

Physical Geology

L+T+P=3+0+1= 4 credits

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

Total Number of Practical Classes (*Practical*): 15 (30 hours)

(i) Course learning outcome

After studying this course, the student will be able to:

CO1 Know about interior of the earth.

CO2 Have the concept of continental drift, plate tectonics.

CO3 Know about weathering and types of weathering, mass wasting and types of mass wasting.

CO4 Know about the continents and ocean basins and their evolution.

CO5 Know about volcanoes, the different aspects of earthquake and earthquake zones in India.

CO6 Know about drainage basins and types of drainage basins.

CO7 Understand geomorphic processes and the resulting common landforms.

(ii) Broad content of the course: The paper presents about interior of the earth, Continental drift, Plate tectonics, mass wasting and types of mass wasting, continents and ocean basins, volcanoes, earthquake, Drainage basins and types of drainage basins, Geomorphic processes and common landforms.

(iii) Skills to be learned: Students will learn to identify, describe and classify landforms. The students will also acquire skills to study and interpret topographic maps, geomorphic models.

Detail contents of this course:

THEORY

Unit 1: Understanding the Earth through seismology (2), Temperature of the Earth's interior (2). Continental Drift, Plate tectonics (4). Weathering - Physical weathering, Chemical Weathering, Biological Weathering, Products of weathering (3), Mass wasting, factors that control slope stability (3), Classification of mass wasting (3)

Unit 2: Major surface features of the earth – continents and ocean basins and their evolution (3), Major internal processes of the earth- Volcanism and volcanoes (3), Types and distribution of volcanoes (2), Earthquake and its causes, Earthquake belts, Earthquake zones of India (5).

Unit 3: Glacial and periglacial processes and landforms (2), Fluvial processes and landforms (3), Drainage and its types (2), Concept of drainage basin (2), Aeolian Processes and landforms (2), Coastal Processes and landforms (2), Landforms associated with igneous activities (2).

PRACTICAL

Study of contours: Pattern of contours to indicate various topographical features (2); Interpretation of topographic maps (5); Drawing of profile and study of geomorphological features from topographic maps (6). Model study of different geomorphic features (2).

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3. Essentials of Geology- Frederick K. Lutgens, Edward J. Tarbuck and Dennis Tasa, Prentice Hall.
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5. Physical Geology – R. F. Flint and J Skinner, John Wiley and Sons, Inc.
6. Textbook of Physical Geology- G. B. Mahapatra, CBS Publishers.
7. Principles of Geomorphology – W. D. Thornbury; John Wiley and Sons, Inc.
8. Engineering and General Geology – P. Singh (6th edition); S. K. Kataria and Sons.

DETAILED SYLLABUS (MDE)

PAPER: GLY24MDE301

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*.
