Department of Geology

Cotton University, Guwahati

B.Sc. SECOND SEMESTER SYLLABUS

PAPER: GLY24C201 Fundamentals of Geology - II L+T+P=4+0+0= 4 credits

PAPER: GLY24M201 Fundamentals of Geology - II L+T+P=4+0+0= 4 credits

PAPER: GLY24MDE201 The Dynamic Earth L+T+P=3+0+0=3 credits

DETAILED SYLLABUS (CORE/MAJOR & MINOR)

PAPER: GLY24C201 Fundamentals of Geology - II L+T+P=4+0+0= 4 credits
PAPER: GLY24M201 Fundamentals of Geology - II L+T+P=4+0+0= 4 credits

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

(i) Course learning outcome
On completion of the course the students will be able to:
CO1 Gain knowledge about geological structures.
CO2 Get to know about arrangement and succession of rock strata.
CO3 Get to know about the existence of past life on earth and their scientific studies with reference to different branches of science. Appreciate how fossils get preserved in rocks, the nature of fossil record and how fossils are named in a taxonomic framework.
CO4 Learn about the Economic Geology.
CO5 Get to know about the sub-surface occurrence of groundwater and how groundwater flow gets affected by the rock properties.
CO6 Classify various geological strata for their engineering use and apply various techniques for the development of various types of engineering structures.

(ii) Broad contents of the course
This paper deals with geological structures, rock strata along with fossil contents, economic importance of geology along application of that knowledge to solve real-world problems in various fields.

(iii) Skills to be learned
This paper bridges the core geological fields with applied aspects of geology like engineering geology and hydrogeology**.**

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

THEORY

Structural Geology: Definition and scope of Structural Geology; Primary and secondary structures; Concept of non-diastrophic and diastrophic structures; non-diastrophic structures: stratification, current or cross bedding, graded bedding, ripple marks, unconformities, mud cracks & rain prints, flow layers, primary joints, vesicular & amygdaloidal structures and pillow structure. (10)

Stratigraphy: Reading rock records, Different principles of stratigraphy, Gaps in stratigraphic records, Relative and absolute dating, Standard stratigraphic time scale. (10)

Palaeontology: Different branches and its relation to allied sciences, Taxonomy and Species concept with special reference to palaeontology; Taxonomic hierarchy; Definition of fossil; Types of fossils; concept of Taphonomy; Fossilization and importance of fossil record. (10)

Economic Geology: Mineral Use and the Human Civilization; Minerals in National and Global Economy; Distinction between Mineral Deposits and Ore Deposits; Nature and Geological Characteristics of Ore Deposits; Classification and Models of Mineral Deposits; Nonmetals, Industrial Minerals and Gemstones; Energy Resources: Coal, Natural Oil & Gas, Nuclear energy, Geothermal Energy, Hydropower, Miscellaneous. (10)

Hydrogeology: Hydrologic cycle, precipitation, evapotranspiration, run-off, infiltration and subsurface movement of water. Vertical distribution of subsurface water. Rock properties affecting occurrence and movement of groundwater. Aquifer, types of aquifers. (10)

Engineering Geology: Role of Engineering geologists in planning, design, and construction of major man-made structures; Site investigation and characterization; Engineering properties of Soil, rocks, and physical characteristics of building stones, concrete, and other aggregates; Concept, Mechanism, and Significance of Rock Quality Designation (RQD); Landslides and related hazards. (10)

Recommended Books:

1. An outline of Structural Geology – B.E. Hobbs, W.D. Means and P.F. Williams; John Wiley and Sons, Inc.
2. Principles of Stratigraphy - C.O. Dunbar and J. Rodgers; *John Wiley and Sons, Inc*.
3. Palaeontology (Palaeobiology) Evolution and Animal Distribution - P.C. Jain and M.S. Anantharaman, Vishal Publishing Co., Jalandhar – Delhi.
4. Deb M, Sarkar SC (2017) Minerals and Allied Natural Resources and their Sustainable Development: Principles, Perspectives with Emphasis on the Indian Scenario. Springer Nature, Singapore.
5. Todd, D. K. (2006), Groundwater Hydrology,2nd Ed., Wiley India Pvt. Ltd., New Delhi, India.
6. Engineering and General Geology - Parbin Singh; S.K. Kataria & Sons.

DETAILED SYLLABUS (MDE)

PAPER: GLY24MDE201 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*.