

# University of Mumbai

## Syllabus for B.Sc I<sup>st</sup> Semester Courses in Geology (June 2016 onwards)

### **Contents:**

- Theory Syllabus for Courses:
  - USGE101 - Introduction to Mineralogy and Crystallography
  - USGE102 - Introduction To Earth Science, Cartography and Structural Geology.
- Practical Course Syllabus for: USGEP1.

**F.Y. B.Sc. Geology**

**Course: USGE101**

**Title: Introduction To Mineralogy and Crystallography**

**Learning Objectives:**

**This is among the first exposure that a learner has to the subject of geology at the undergraduate level. The aim of this course is to develop in the learner an ability to understand and identify various minerals along with their characteristic crystallographic properties, as this forms one of the fundamental requirements in the later profession.**

**Number of lectures: 45**

**Unit 1**

**Mineralogy:**

**(15 Lectures)**

Chemical bonds and formation of compounds.

Minerals: definition, chemical compositions and classification.

Physical properties of minerals: colour, streak, luster, diaphaneity, form, habit, cleavage, fracture, hardness, specific gravity, and electrical and magnetic properties.

Isomorphism, polymorphism and pseudomorphism.

**Unit 2**

**Elementary Crystallography:**

**(15 Lectures)**

States of matter: crystalline state.

Elementary ideas about the crystal structure.

External characteristics of crystals: face, form, edge, solid angle, interfacial angle and its measurement, zone.

Crystal symmetry: planes, axes and center of symmetry.

Crystallographic axes and axial angles, parameters, indices and rational indices.

Classification of crystals into seven systems.

Study of the normal classes belonging to following systems:

Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic.

**Unit 3**

**Descriptive Mineralogy of Rock forming minerals:**

**(15 Lectures)**

Structural classification of silicates.

Feldspars, Silica, Pyroxene, Amphibole, Mica, Olivine.

**List Of Recommended Reference Books**

1. Dana J.D. and Ford W.E. (rev. ed.) (2010), Dana's Manual of Mineralogy, J. Wiley & Sons.
2. Read H.H. (Rev. ed. C.D. Gribble) (1988), Rutley's Elements of Mineralogy" (27<sup>TH</sup> Edition), CBS Publications.
3. Perkins D (2010). Mineralogy (3<sup>rd</sup> Edition), Prentice-Hall of India.

**F.Y. B.Sc. Geology**

**Course Code: USGE102**

**Title: Introduction To Earth Science, Cartography And Structural Geology**

**Learning Objectives:**

The primary platform for any learner attempting to understand geology, is our planet earth. As this course is among the introductory courses at the undergraduate level, it needs to communicate and also attempt at the learner becoming acquainted the various theories about the origin of the universe and our solar system. After that the learner needs to know the theories that lead to the understanding about the planets interior and the energy systems that drive the various internal (sub-surface and deep interior) systems along with the linkages between the interior and the atmospheric circulation. This leads to an understanding about the internal and external processes on our planet and how various structures within rocks form due to earth's internal forces.

**Number of lectures: 45**

**Unit-1:**

**15**

**Lectures**

**Earth in the Solar System:**

Geology and its perspectives.

Earth in the Solar System: Earth's Origin, size, shape, mass, density, rotational parameters.

**Earth's Internal structure:** core, mantle, and crust.

Hydrosphere, Atmosphere and Biosphere: characteristics and elemental abundance in each constituent. Convection in the earth's core and production of its magnetic field.

Age of the earth.

**Unit-2:**

**15**

**Lectures**

**Atmospheric circulation and Global climatic changes:**

Atmospheric circulation, weather and climate changes.

Land-air-sea interaction.

Earth's heat budget and global climatic changes.

**Ocean currents:**

Generation of oceanic currents, surface currents and global ocean conveyor system.

Ocean as a thermostat for the earth's surface heat balance.

**Cartography:**

Maps and Topographical maps; latitude – longitude concepts, Datum, map projections, types of maps, SOI map index, Contours and contour reading: Scales and Compass bearings, map grids (UTM).

**Unit-3:**

**15 Lectures**

**Structural Geology:**

Stratification; Dip and Strike; Clinometer compass its use.

Outcrop pattern of horizontal, dipping and vertical strata on various types of topography.

Outliers, Inliers.

Folds: Definition, Morphology, anticline and syncline.

Types of folds: symmetrical, asymmetrical, recumbent, overturned, isoclinal, plunging, doubly plunging, structural dome and basin, monocline, structural terrace, chevron, fan, anticlinorium, synclinorium, Importance of folds.

Joints: Definition, geometric classification and importance.

Faults: morphology; geometric classification based on relation to affected rocks, angle of dip, apparent movement and relative movement; distributive faulting: horst, graben and step faults; nappes.

Unconformities: nature, types and importance; overlap and off-lap.

### **List Of Recommended Reference Books**

1. Compton R.R. (1985), Geology in The Field., J. Wiley & Sons
2. Skinner B.J., Porter S.C. and Botkin D.B. (1999), The Blue Planet., 2nd edn. J. Wiley & Sons.
3. Holmes A. (1993), Principles of Physical Geology., ed by David Duff, Nelson Thornes Ltd
4. Billings M.P. (1987), Structural Geology., 3rd edn, Prentice-Hall, India Pvt. Ltd
5. Robinson. A, Morrison. J, Muehrcke. P, Kimerling. A, Guptill. S (1995), Elements of Cartography, 6 ed, J. Wiley & Sons.
6. Siddhartha K., (1999) , Oceanography - A Brief Introduction., Kosalaya Publ., India
7. Butz S. (2007) Science of Earth Systems., 2nd edn., Thomas Delmar.

### **Practical Course: (USGEP1)**

- I. Study of crystal models representing forms of seven normal classes of symmetry.
- II. Identification and description of the physical properties, composition, occurrences and uses of 30 rock forming minerals.
- III. Use of Clinometer and Brunton compasses
- IV. Description and drawing of vertical cross section of simple geological maps involving horizontal or dipping strata with vertical faults, folded (non-plunging and non-faulted) strata and strata involving angular unconformity.
- V. Graphical solution of structural geology problems involving
  - a. Strike, true dip and apparent dip
  - b. Thickness and width of outcrop.

# University of Mumbai

  

## Syllabus for BSc II<sup>nd</sup> Semester Courses in Geology (November 2016 onwards)

### Contents:

- Theory Syllabus for Courses:
  - USGE201-Introduction to Petrology, Geotectonics and Economic Geology.
  - USGE202-Introduction to Physical Geology, Principles of Stratigraphy and Paleontology.
- Practical Course Syllabus for: USGEP2

**Learning Objectives:** As a part of the four formative courses which introduce the learner to the basics of geology, this module incorporates the necessary topics to appreciate and understand the processes which lead to the formation of various rock types and mineral deposits along with their relationship to tectonism. A brief understanding of the methods of exploration and exploitation of earth's natural resources is also discussed.

**Number of lectures: 45**

**Unit 1**

**(15 lectures)**

• **Igneous Petrology**

Rocks: definition, their classification.

Magma: definition, composition, origin, Bowen's Reaction Series, magmatic differentiation and assimilation.

Mode of occurrences, Intrusive and Extrusive forms.

Textures and structures.

Classification based on grain size and mineral composition.

**Metamorphic Petrology**

Metamorphism: definition, agents and types of metamorphism.

Metamorphic minerals: stress and anti-stress minerals, textures and structures.

Metamorphic facies and isograds, Relationship between metamorphism and deformation.

Rock cycle.

**Unit 2**

**(15 lectures)**

• **Sedimentary Petrology**

Sediments: weathering, transport, deposition, consolidation, diagenesis.

Textures and structures.

Classification: Terrigenous and Chemical sedimentary rocks.

**Mineral Deposits**

Classification and brief study of following mineral deposits: Hydrothermal, Magmatic, Sedimentary (evaporites, strata-bound, bedded iron formations), Placer, Residual.

**Unit 3**

**(15 lectures)**

• **Introduction to Mineral Exploration and Mining:**

Methods of mineral exploration: Surface methods – grid sampling. Sub-surface methods – Seismic, Electrical, Magnetic and Electrical.

Basic ideas about the methods of mining.

• **Geotectonics:**

**Earthquakes:** causes, effects, tsunamis, measurement of earthquakes, seismic belts, seismic zonation in India.

**Volcanoes:** types, causes and distribution.

Origin of Mountains, Oceans and Continents.

General relief features of the ocean floor.

**List Of Recommended Reference Books**

1. Ehlers, E.G. and H. Blatt (1982), Petrology, Igneous, Sedimentary and Metamorphic, W.H Freeman, San Francisco
2. Tyrell G.W. (1980), Principles of Petrology: An Introduction to the Science of Rocks., 1st Indian Edn., B.I. Publ. India.

3. Ramam P.K. (1989), Principles and Practices of Mineral Exploration., Publ. Geol. Soc. Ind.
4. Arogyaswami R.N.P. (1973), Courses in Mining Geology., Oxford & IBH
5. Agoskhov M., Borisov S., Layansky V. (1888), Mining of Ores and Non-metallic Minerals., Mir Publishers

**F.Y. B.Sc. Geology**

**Course: USGE202**

**Title:**

**Introduction to Physical Geology, Principles of Stratigraphy and Paleontology**

**Learning Objectives:**

As the fourth module in the introductory courses in geology, the learner is exposed to the now accepted modern day concept of plate tectonics, which also explains the various surface features on our planet. The learner develops an understanding about the various surface phenomenon that lead to the development of soil and the breakdown of landforms. The last unit in this module introduces the learner to the basics of stratigraphy, whereby the concept of age related geological activities which shaped our planet are explained. Also explained is the basis of formation of fossils.

**Number of lectures: 45**

**Unit 1 Introduction to Plate Tectonics and Physical Geology (15 Lectures)**

Theory of Plate Tectonics and its proofs .

Introduction to Weathering and Erosion; Exogenic and endogenic geomorphic processes; Evolution of landscape.

Soil: definition, formation and functions; soil profile.

**Unit 2 Landforms (15 Lectures)**

Wind: erosion, transport and deposition; Aeolian landforms.

Rivers: development of a typical river system; erosion, transportation and deposition; Fluvial landforms

Glaciers: types, formation and morphology; erosion, transport and deposition; Glacial landforms.

Oceans: marine erosion and deposition; Coastal landforms.

**Unit 3 Introduction to Principles of Stratigraphy and Paleontology (15 Lectures)**

Definition of stratigraphy. Nature of stratigraphic records.

Principles of Stratigraphy- superposition, initial horizontality, lateral continuity, floral and faunal succession, cross-cutting relationship, and uniformitarianism.

Concept of time in geology. Geological time scale. Unconformities- types, formation and applications.

Introduction to paleontology. Fossils- definition, types of fossils, modes of preservation. Applications of fossils in geology.

**List Of Recommended Reference Books**

1. Benton M.J. and Harper D.A.T. (2009), Introduction to Paleobiology and Fossil Record, Wiley-Blackwell Publication.
2. Ray Anis. K, (2008), Fossils in Earth Sciences, Prentice Hall of India
3. Butz S. (2007) Science of Earth Systems., (2<sup>nd</sup> Edition), Thomas Delmar.
4. Dasgupta, A.,(2005), Introduction to Palaeontology, (1<sup>st</sup> Edition), World Press
5. Skinner B.J., Porter S.C. and Botkin D.B. (1999), The Blue Planet., (2<sup>nd</sup> Edition) J. Wiley & Sons.
6. Holmes A. (1993), Principles of Physical Geology., ed by David Duff, Nelson Thornes Ltd
7. Emiliani C. (1992), Planet Earth: cosmology, geology and evolution of life and environment, Cambridge University Press.
8. Weller J.M. (1960), Stratigraphic Principles and Practice, Harper.

**Practicals (USGEP2)**

- I. Identification of group characteristics of 25 common rocks and their classification into major rock groups. Identification and systematic description of the megascopic features of these rocks.
- II. Identification and description of the physical properties, composition, occurrences of 10 commonly occurring economic ore minerals.
- III. Study of 3D models of the various landforms formed due to the geomorphic processes.
- IV. Correlation of the lithologs and their interpretations.