

# DRAFT SYLLABUS UNDER AUTONOMY

## GEOLOGY

SEMESTER I

COURSE : S.GEO.1.01

### INTRODUCTION TO MINERALOGY, CRYSTALLOGRAPHY AND STRATIGRAPHY GEOLOGY [45 lectures]

#### LEARNING OBJECTIVES:

To develop an ability to understand and identify various minerals along with their characteristic crystallographic properties and to understand the evolution of life through geological ages.

#### Unit-I:

[15 Lectures]

##### Mineralogy

Chemical bonds and formation of compounds.

Minerals: definition, chemical compositions, classification and silicate structures.

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

Isomorphism, polymorphism and pseudomorphism.

##### Mineral groups

Introduction to rock forming minerals: Feldspars, Silica, Pyroxene, Amphibole, Mica, Olivine.

Ore-forming and industrial minerals

##### Mineral Deposits

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

#### Unit-II:

[15 Lectures]

##### Elementary Crystallography

##### 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- III: Principles of Stratigraphy**

**[15 Lectures]**

Principles, correlation of strata

Standard stratigraphic scale, Indian stratigraphic scale.

Study of the general geographical and climatic conditions and life during the various eras of earth history with brief reference to the lithology of Indian formations of those eras and special reference to:

1. Age of fishes
2. Permocarboniferous period
3. Age of reptiles
4. Evolution of birds
5. Age of mammals
6. Evolution of man
7. Ice ages
8. Major Phanerozoic orogenic events.

**COUNTINUOUS INTERNAL ASSESSMENT:**

- **Field work with field report and viva on the fieldwork**

## SEMESTER I

COURSE : S.GEO.1.02

### INTRODUCTION TO EARTH, ATMOSPHERIC SCIENCES, CARTOGRAPHY AND STRUCTURAL GEOLOGY [45 lectures]

#### LEARNING OBJECTIVES:

To develop an understanding about the internal and external processes on our planet and how various structures within rocks form due to earth's internal forces.

#### Unit-1:

[15 Lectures]

##### **Earth in the Solar System**

Geology and its perspectives.

Earth in the Solar system: Origin, size, shape, mass, density, rotational parameters.

##### **Earth's Internal Structure and Age**

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.

Radioactivity

Age of the earth.

#### Unit-II:

[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-III:

[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.

**COUNTINUOUS INTERNAL ASSESSMENT:**

- **Field work with field report and viva on the fieldwork**

**SEMESTER II**

**COURSE : S.GEO.2.01**

**INTRODUCTION TO PETROLOGY, GEOTECTONICS AND ECONOMIC GEOLOGY** [45 lectures]

**LEARNING OBJECTIVES:**

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.

**Unit-I:**

**[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-II:**

**[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-III**

**[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.

**COUNTINUOUS INTERNAL ASSESSMENT:**

- **Field work with field report and viva on the fieldwork**

**SEMESTER II**

**COURSE : S.GEO.2.02**

**INTRODUCTION TO PHYSICAL GEOLOGY AND**

**PLAEONTOLOGY**

**[45 lectures]**

**LEARNING OBJECTIVES:**

To develop an understanding of earth's surface processes and systematic study with an aim of developing identification skills of the various past evidences of life on our planet.

**Unit-I:**

**[15 Lectures]**

**Weathering and Erosion**

Introduction to Weathering and Erosion.

Soil: definition, formation and functions; soil profile and soil types.

**Rivers:** development of a typical river system, source and surface flow; erosion, transportation and deposition.

**Wind:** erosion, transport and deposition; types of deserts and dunes; loess.

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

## **Unit-II:**

**[15 Lectures]**

### **Introduction to Palaeontology**

Definition and scope of Palaeontology

Processes of fossilization, preservation potential of organisms.

Uses of fossils, zone fossils.

Systematic classification of organisms.

Elementary ideas about the origin of life, evolution and fossil record.

### **Morphology of Fossils-I**

Systematic study of morphological characters, classification, environmental factors and geological distribution of the following groups:

Arthropoda: **Trilobites**

Coelenterata: **Corals** (simple corals and compound hexa-corals and octa-corals)

## **Unit-III**

**[15 Lectures]**

### **Morphology of Fossils-II**

Systematic study of morphological characters, classification, environmental factors and geological distribution of the following groups:

**Brachiopoda, Mollusca: Lamellibranchs, Gastropods, Cephalopods.**

Systematic study of morphological characters, classification, environmental factors and geological distribution of the following groups:

**Graptoloidea. Echinodermata: Regularia and Irregularia**

### **CONTINUOUS INTERNAL ASSESSMENT:**

- **Field work with field report and viva on the fieldwork**

### **REFERENCES:**

1. "The Blue Planet" (II Edition), Skinner B.J., Porter S.C. and Botkin D.B. (J. Wiley & Sons)
2. "Physical Geology" (VII edition), Judson, Kauffman and Leed (Prentice Hall).
3. "Holmes' Principles of Physical Geology", Holmes D.L.;(ELBS & Nelson)
4. "Structural Geology"; Billings M.P. (Prentice Hall)
5. "Rutley's Mineralogy"; Read H.H. (CBS)
6. "Elements of Cartography", Robinson. A, Sale. R, Morrison. J, 6 ed, J. Wiley & Sons.
7. "The Principles Of Petrology"; Tyrell G.W.

8. "Invertebrate Petrology"; Wood; (CBS)
9. "Principles of invertebrate Paleontology"; Shrock & Twenhofel, (CBS)
10. "Principles of Paleontology"; Raup & Stanley, (CBS)
11. "Fundamentals of Historical Geology & Stratigraphy of India"; Ravindra Kumar, (Wiley Eastern India)
12. "Principles And Practices of Mineral Exploration"; P.K.Raman (Geol, Soc. India, Bangalore)(1989)
13. "Mining of Ores and Non-metallic Minerals"; M. Agoskhov S. Borisov & V.Layansky, (Mir Publications, Moscow)(1988) Ch.2 & Ch. 17
14. "Courses in Mining Geology"; Arogyaswami, (Oxford & IBH).
15. "Oceanography – A brief Introduction", siddhartha. K., (Kisalaya Publications, India)

## **PRACTICALS**

### **SEMESTER I**

**COURSE : S.GEO.1.PR**

#### **PRACTICALS 1. AND 2.**

1. Study of twenty-five crystal models representing forms of seven normal classes of symmetry.
2. Identification and description of the physical properties, composition, occurrences and uses of 30 minerals comprising rock forming, industrial and ore minerals.
3. 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.
4. Identification, classification, description and geological time range of twenty-five fossils belonging to the phyla included in the theory syllabus.

### **SEMESTER II      COURSE : S.GEO.2.PR**

#### **PRACTICALS 1. AND 2.**

1. Reading of topographical maps.
2. Use of Clinometer and Brunton compasses
3. 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.
4. Completion of outcrops involving horizontal and inclined strata that may have been affected by vertical fault.
5. Graphical solution of structural geology problems involving
  - i. Strike, true dip and apparent dip
  - ii. Thickness and width of outcrop.

## **GEOLOGICAL FIELD TRAINING**

- Students will be required to carry out local fieldwork for 4 days in a suitable geological area to study the elementary aspects of field geology and to submit a report thereon.
- Out of 40 marks of each Practical, 10 marks each should be allotted for the assessment of the field report submitted by the students.