B.Sc. I Semester, Geology 2024 – 2025

Discipline Centric Core Course – Geology – I
Theory Paper (GEO1.1T) – Earth System Science
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
1. Preliminary acquaintance about Geology.
2. Introductory knowledge of Earth. Its inorganic and organic constituent and landscaping processes and landforms. Introduction to stress generated structures of the earth.

Course Outcomes: The course helps the students to understand:
1. About the various aspects of the Earth, its internal and external features.
2. Origin of landscapes. Stress induced features.

Unit I

Geology and its branches, scopes and applications. Introduction to the solar system. Earth: Origin, size, shape, mass and density. Chemical composition of the Earth. Internal structure of the Earth: Crust, Mantle and Core. Earth's gravity and magnetic field. Formation of hydrosphere, atmosphere and biosphere. Age of the Earth.

Unit II

Continental Drift Theory. Basic concept of Sea floor spreading and Plate Tectonics. Origin of Oceans, Continents and Mountains. Concept and application of palaeomagnetism.

Unit III

Geomorphic agents and processes: Weathering – their types, Erosional processes. Difference between Weathering and Erosion. Geological works of wind, river, glacier and their landforms. Physical features of Oceans with special emphasis on Deep Sea trenches, Mid-oceanic Ridges and Abyssal plain.

Unit IV

Introduction to Earthquake: Their causes, effects and distribution. Volcanoes: Types, Volcanic landforms and distribution. Physical division of India and characteristics. Geomorphic Divisions of Rajasthan and characteristics.

Unit V

Concept of Isostasy and Island arch. Evolution of Himalaya and Indo-Gangetic Plain. Salient features of Toposheets and Geological Maps. Clinometer Compass: It's construction and uses.

Discipline Centric Core Course

Practical – I (GEO1.2P) – Earth System Science

50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Draw Physical divisions of India and Rajasthan in respective maps.
- Draw distribution of earthquakes and important mountains in map of the world.
- Draw landforms of rivers, wind, glaciers and volcanoes.
- Study of physical models showing geomorphic features.
- Study of topographic maps.
- Interpretation of various geomorphic landforms and drainage patterns on toposheet.
- Map exercise related to plotting of major mountain ranges, lakes and rivers of India and seismic map of India.

Distribution of Marks in Practical Exam:		
Practical Exercises	:	30 marks
Viva – voce	:	10 marks
Record	:	10 marks

Books Recommended:

1. Mukherjee P. K., (1991) A Text Book of Geology CBS Publisher and Dist., New Delhi.
2. Datta A. K., An introduction to Physical Geology –Dastane Ram.
3. Mahapatra, G. B.: Text book of Physical Geology. CBS Publication
4. Mukul Ghosh. Bhautik Bhuvigyan.
5. Bhattacharya, A. R.(2022) Structural Geology, Springer, 468p.
6. Lahee, (1961) Field Geology Frederic Henry, Mc-Graw Hill Book Comp., London, N. York.
7. Agrawal, V., Kapasya, H. and Sen, H. (2023), Introduction to Geology, Raghav Publication, New Delhi
8. Parbin Singh: Engineering and General Geology, S.K. Kataria & Sons, New Delhi

B.Sc. II Semester, Geology 2024 – 2025

Discipline Centric Core Course – Geology – II
Theory Paper (GEO2.1T) – Mineral Science

100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
The course for the Mineral Science is aimed to provide a glance to different crystals and rock forming minerals , crystal structure, physicochemical and optical properties of minerals usful in their identification.

Course Outcomes:
The course helps the students to understand the geological, commercial and social significance of Minerals.

Unit I

Crystallography: Definition of Crystal, crystal faces, edges, interfacial angles, solid angle, zone and crystal forms. Crystallographic axes and axial angles. Crystal Symmetry Elements. Parameters and Indices of Crystal Notations, Twinning in crystals. Classification of crystals into seven crystal systems. Study of normal classes of the following Crystal Systems – Cubic, Tetragonal, Orthorhombic and Hexagonal System.

Unit II

Ordinary and polarized light, isotropic and anisotropic minerals, Reflection and refraction of light, Refractive index, critical angle, Becke's effect, Double refraction. Nicol Prism: its construction and working. Petrological microscope: its parts and functioning. Optical properties of minerals, relief, birefringence and pleochroism, interference colour, extinction and its types, extinction angle and twinning. Introduction to Uniaxial and biaxial characters of minerals. Study of optical properties of Muscovite, Biotite, Quartz, Orthoclase, Microcline, Plagioclase, Olivine, Garnet, Augite, Hornblende and calcite.

Unit III

Definition and classification of minerals. Silicate structures, Concept of Isomorphism and Polymorphism. Physical Properties of Minerals: Forms, Colour, Streak, Lusture, Cleavage, Fracture, Hardness, Specific Gravity, Electrical, Magnetic and Radioactive properties. Chemical composition, physical and optical properties of the following group of minerals: Olivine, Pyroxene and Amphibole.

Unit IV

Chemical composition, physical and optical properties of the following group of minerals: Mica, Silica, and Feldspar.

Unit V

Chemical composition, physical and optical properties of the following minerals: Garnet, Feldspathoids, Chlorite, Epidote, and Carbonates.

Discipline Centric Core Course

Practical – II (GEO2.2P) – Mineral Science

50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Study of physical properties of the rock and ore forming minerals like: Olivine, Garnet, Kyanite, Sillimanite, Andalusite, Epidote, Tourmaline, Augite, and Hornblende. Chlorite, Biotite and Muscovite. Silica and its varieties, Feldspar (Orthoclase, Microcline, Plagioclase), Nepheline.
- Study of symmetry elements in crystal models.
- Study of Fundamental forms of normal classes of Cubic, Tetragonal, Orthorhombic and Hexagonal crystal systems.
- Study of the optical properties of important rock forming minerals using petrological microscope like: Muscovite, Biotite, Quartz, Microcline, Plagioclase, Calcite, Olivine, Garnet, Augite and Hornblende.

Note: 2 Days Geological Field Training Program should be organized

Distribution of Marks in Practical Exam:		
Practical Exercises	:	30 marks
Viva – voce	:	10 marks
Record + Field Report	:	10 marks

Books Recommended:

1. Read, H.H. (1962) Rutley's Elements of Mineralogy Reprint CBS Pub. & Dist., New Delhi
2. Ford W. E., (2006) Dana's Text Book of Mineralogy CBS Pub. & Dist., New Delhi.
3. R.S. Sharma and Anurag Sharma, 2013. Crystallography and Mineralogy – concept and methods. Geological Society of India, Bangalore.
4. Dexter Perkins, 2014. Mineralogy. Pearson New International.
5. Umeshwar Prasad 2008. Economic Mineral Deposits. CBS Publishers and Distributors.
6. Alexander P. O. (2008), Handbook of Minerals, Crystals, Rocks and Ores, New Age India.
7. Agrawal, V., Kapasya, H. and Sen, H. (2023), Introduction to Geology, Raghav Publication, New Delhi
8. Parbin Singh: Engineering and General Geology, S.K. Kataria & Sons, New Delhi

B.Sc. III Semester, Geology 2024 – 2025

Discipline Centric Core Course – Geology – III
Theory Paper (GEO3.1T) – Petrology

100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objectives:

1. To impart knowledge of basic elements of Petrology
2. To train the students to understand the processes of formations of different rock groups and textures –structures of the rocks.

Course Outcomes:

Upon successful completion of course the students would be able to understand:

1. The basic concept of petrology.
2. Magma generation, evolution and formation and classification of igneous rocks.
3. Fundamentals of sedimentary processes and types of sedimentary rocks.
4. Fundamentals of metamorphism, types of metamorphic rocks and their processes of formation and classification.

Unit I

Definition of Petrology and its branches. Composition and constitution of magma. Bowen's Reaction Series. Forms, Structures and Textures of Igneous rocks.

Unit II

Elementary idea of classification of Igneous rocks based on Mode of occurrences, Mineralogical and Geochemical parameters. Tabular classification of Igneous rocks. Megascopic and microscopic characteristics and petrogenesis of the following igneous rocks: Granite, Syenite, Gabbro, Pegmatite, Rhyolite, and Basalt.

Unit III

Definition of Metamorphism, its kinds, and agents. Concept of depth zones, facies and grades of metamorphism. Texture and structures of metamorphic rocks. Introduction to cataclastic, thermal, and dynamo-thermal metamorphism and their products. Megascopic and microscopic characteristics and petrogenesis of following metamorphic rocks: Quartzite, Marble, Slate, Phyllite, Schist, Gneiss, and Granulite.

Unit IV

Sediments and Sedimentary rocks, the process of their formation; Sedimentary structures and textures. Classification of clastic and non – clastic sedimentary rocks.

Unit V

Characteristics and petrogenesis of common sedimentary rocks: Arkose, Sandstone, Siltstone, Shale, Conglomerate, Breccia, Limestone, Dolomite and Phosphorite. Elementary knowledge of sedimentary environments. Characteristics of their products: Glacial, Lacustrine, Fluvial, Deltaic Shore line, Shelf and deep marine environments.

Discipline Centric Core Course
Practical - III (GEO3.2P) – Petrology

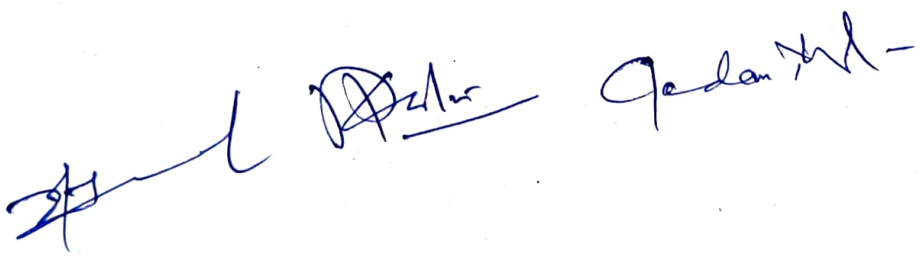
50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Petrographic description of common igneous, metamorphic, and sedimentary rocks in hand specimens, including minerals, texture and structure.
- Identification of rocks under microscope: Igneous Rocks (Granite, Rhyolite, Syenite, Pegmatite, Dolerite, Gabbro, and Basalt). Metamorphic Rocks (Quartzite, Marble, Slate, Phyllite, Schist, Gneiss, Charnockite, Migmatite, and Granulite). Sedimentary Rocks (Arkose, Sandstone, Siltstone, Shale, Conglomerate, Breccia, Limestone).

Distribution of Marks in Practical Exam:		
Practical Exercises	:	30 marks
Viva – voce	:	10 marks
Record	:	10 marks

Books Recommended:

1. Tyrrel G.W.: The Principles of Petrology. B.I. Publications Pvt. Ltd., 13, Daryaganj, New Delhi – 2
2. John D. Winter, 2014. Principles of Igneous and Metamorphic Petrology. Pearson Education Limited
3. Sengupta S.M., 2008. Introduction to Sedimentology. CBS Publishers and Distributors.
4. Sharma R.S., 2016. Petrology, Concept & Methods. Geological Society of India, Bangalore.
5. Pettijohn F. J. : Sedimentary Rocks. CBS
6. Agrawal, V., Kapasya, H. and Sen, H. (2023), Introduction to Geology, Raghav Publication, New Delhi
7. Parbin Singh: Engineering and General Geology, S.K. Kataria & Sons, New Delhi



B.Sc. IV Semester, Geology 2024 – 2025

Discipline Centric Core Course – Geology – IV
Theory Paper (GEO4.1T) – Stratigraphy

100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
1. To impart basic knowledge about Geological Time Scale and Principles of Stratigraphy.
2. Provide introductory knowledge of Precambrian and Phanerozoic stratigraphy of India.

Course Outcomes: Upon successful completion of course the students would be able to:
1. Understand the basic concept of stratigraphy.
2. Understand fundamentals of stratigraphy and its branches.
3. Understand stratigraphy and sedimentation history of different sedimentary basins of India.
4. Understands Geological time scale and evoluation of life during geological time.

Unit I

Definition of Stratigraphy. Geological Time Scale. Law of Superposition. Chronological (Time unit), Geochronological (Time Rock unit) and Lithological (Rock unit) classification. Stratigraphic correlation.

Unit II

Introduction to Cratons of India. Archean Geology of Dharwar Craton, Singhbhum Craton, Baster Craton, Eastern Ghat Craton and Rajasthan Craton.

Unit III

Proterozoic: Distribution, classification, lithology and economic importance of Aravalli Supergroup, Cuddapah Supergroup, Delhi Supergroup, and Vindhyan Supergroup. Erinpura Granites and Sirohi Group, Marwar Supergroup and Malani Igneous Suite of Rajasthan.

Unit IV

Distribution, classification, lithology and fossil content of Palaeozoics and Mesozoics of Salt Range, Spiti (Triassic age), Kashmir and Kumaun Himalaya. Mesozoics of Rajasthan. Jurassic of Kachchh, Cretaceous of Trichinopoly. Gondwana Supergroup and Deccan Traps.

Unit V

Tertiary Rocks of Asam, Rajasthan (Barmer, Jaisalmer and Bikaner - Nagaur Basins) and Kachchh. Siwalik Supergroup. Quaternary Geology of Indo-Gangetic plains and Thar Desert.

Discipline Centric Core Course
Practical - IV (GEO4.2P) – Stratigraphy

***50* Marks, Credits 2** **Exam Duration: 6 Hours**

- Demarcation of Palaeogeography of various periods in outline map of India.
- Identification and arrange in Stratigraphic order of characteristic stratigraphic rock samples.
- Demarcation of important geological formations/Supergroups of Indian Stratigraphy in outline map of India.
- Demarcation of Geological formation in the map of Rajasthan.

Note: 2 – 3 Days Geological Field Training Program should be organized

Distribution of Marks in Practical Exam:		
Practical Exercises	:	30 marks
Viva – voce	:	10 marks
Record + Field Report	:	10 marks

Books Recommended:

1. Ravindra Kumar: Fundamentals of Historical Geology and Stratigraphy of India. Willey Eastern New Delhi
2. Ramakrishnan M. & Vaidyanadhan R., 2010. Geology of India, Vol-I and Vol-II, Geol. Soc. India, Bangalore.
3. Bharatvarsh Ka Bhu Vigyan : Madhya Pradesh Hindi Granth Academy, Bhopal.
4. Krishnan M S : Geology of India and Burma, C. B. S. Publication, New Delhi.
5. Roy A. B. & Jakhar S.R. 2002 : Geology of Rajasthan (Northwest India) Precambrian to Recent. Scientific Publishers (India), Jodhpur.
6. Amal Dasgupta, 2010. Phanerozoic Stratigraphy of India. The World Press Pvt. Ltd. Kolkata.
7. Roy A.B. & Ritesh Purohit R., 2018. Indian Shield, Precambrian Evolution and Phanerozoic Reconstitution. Elsevier
8. Agrawal, V., Kapasya, H. and Sen, H. (2023), Introduction to Geology, Raghav Publication, New Delhi
9. Parbin Singh: Engineering and General Geology, S.K. Kataria & Sons, New Delhi