

As per the NEP 2020
BA/B.Sc. Geology
(Effective from Academic Year 2024-2025 onwards)



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Semester – I

Learning Objectives & Outcomes

- Students are expected to learn about the dynamic planet Earth and the processes responsible for it.
- Students will understand the exogenic and endogenic processes responsible for the earth's landscape.
- Students will also appreciate the role of rock parameters in the field of hydrogeology and structural geology.

Course Title:	Earth System Science (ESS)	Course Code: 24BGL5101T
Total Lecture hour 45		Hours
Unit I	Introduction to Earth as Planet Holistic understanding of Earth as a dynamic planet. Introduction to various branches of Geology. General characteristics and origin of the Universe. Solar System, and its planets. The terrestrial and jovian planets. Meteorites and Asteroids. Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters, and its age. Geological Time Scale.	12
Unit II	Interior and Exterior of Earth's Surface Formation of core, mantle, crust, hydrosphere, atmosphere, and biosphere Convection in Earth' core and production of its magnetic field. The mechanical layering of the Earth. Concept of Plate Tectonics. Sea-Floor Spreading, and Continental Ori ft. Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults, and island arcs. Origin of oceans, continents, mountains, and rift valleys. Earthquake and earthquake belts. Volcanoes- types, products, and their distribution.	13
Unit III	Fundamentals of Geomorphology Introduction to Geomorphology. Endogenic and Exogenic processes. Weathering and associated landforms and Hill slopes. Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, and Coastal Processes and landforms.	10
Unit IV	Fundamentals of Hydrogeology Definition of hydrogeology Hydrological cycle; Hydrological parameters - Precipitation evaporation, transpiration, and infiltration. Origin of groundwater: Vertical distribution of groundwater, Types of aquifers· Water bearing properties of rock. Groundwater provinces of India. Fundamentals of Structural Geology: Concept of strike and dip. Description and applications of clinometer compass. Primary sedimentary structures: Types of Bedding. Igneous structures. Metamorphic structures: Foliation, Cleavages. Definition and Classification of Fold, Fault. Joint. Lineations, and Unconformity. Description of Stress, Strain. Outliers, Inliers, Overla and Offla	10

Course Title:	Geology Lab Earth System Science (ESS)	Course Code: 24BGL5101P
	1. Draw the physical divisions of India and Rajasthan on respective maps. 2. Draw the distribution of earthquakes and major mountains on the map of the world and India. 3. Geological Time Scale. 4. Earth's internal structure. 5. Draw landforms of rivers, wind, glaciers, and volcanoes. 6. Study of physical models showing geomorphic features.	

	7. Configuration and numbering of topographic maps on various scales. 8. Interpretation of various geomorphic landforms and drainage patterns on toposheets. 9. Map exercise related to the plotting of major mountain ranges, lakes, and rivers of India & seismic data on the map of India. 10. Measurement of strike and dip. 11. Identification of structural features in hand specimens.
Reference Books:	
	1. Holmes, Arthur. 1992. <i>Principles of Physical Geology</i>. Chapman and Hall, London. 2. Miller, 1949. <i>An Introduction to Physical Geology</i>. East-West Press Ltd. 3. Spencer, E. V. 1962. <i>Basic Concepts of Physical Geology</i>. Oxford & IBH. 4. Mahapatra, G. B. 1994. <i>A Textbook of Physical Geology</i>. CBS Publishers. 5. Press and Siever. 1998. <i>Understanding Earth</i>. W. H. Freeman & Co. 6. Emiliani, C. 1992. <i>Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment</i>. Cambridge University Press.

Semester – II

Learning Objectives

Students will get the idea of a broad overview of both minerals and ore-forming minerals and their application to differentiate between minerals and to imagine the crystals in three dimensions. Students will be understanding the ore deposits.

Course Title:		Mineral Science	Course Code: 24BGL5201T
Total Lecture hour 45			Hours
Unit I	Crystal - Concept of Crystalline and non-crystalline substances: Interfacial angle and external morphology in relation to internal structures; Crystal parameters and indices; form and zone. Crystal symmetry, classification of crystals into systems. Hermann-Mauguin symbol, Holohedrism, hemihedrism, hemimorphism, and enantiomorphism. Study of axial relationship, symmetry elements, and forms present in the different normal classes. Fundamentals of stereographic projection of crystals and their uses. Twinning and Twin Laws: common types of twins and their examples in minerals.		12
Unit II	Fundamentals of Mineralogy - Scope of mineralogy. Chemical bonding and compound formation. Definition and classification of minerals. Physical properties of minerals; isomorphism and polymorphism. Silicate structure and its classification. Nature of light - wave theory of light, reflection, refraction, polarization, double refraction. Introduction to the petrological microscope. Optical properties of minerals - isotropic and anisotropic minerals, refractive index and optical indicatrix, pleochroism, and pleochroic scheme; extinction and interference figures.		10
Unit III	Properties of Silicate Minerals - Study of atomic structure, chemistry, physical, optical properties, and uses of minerals of Olivine, Feldspar, Pyroxene, Amphibole, Garnet, and Mica groups.		13
Unit IV	Properties of Metallic Minerals - Physical and chemical characteristics, optical properties, and uses of metallic minerals of Lead, Zinc, Copper, and Iron. Ore Minerals and Genesis - Importance of crustal evolution in the metallogenesis. Metallogenic epochs and provinces. An overview of various Indian Mineral deposits in		10

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	Metallogenic epochs and provinces. An overview of various Indian Mineral deposits in cratons and mobile belts. Mineralogy, and genesis of major bauxite, iron ore, and manganese deposits of India. Mineralogy and mode of occurrence of major copper, lead-zinc, and chromium deposits of India.
Reference Books:	
	1. Klein, C., Dutrow, B., Dwight, I., and Klein, C., 2007. <i>The 23rd Edition of the Manual of Mineralogy</i>. 2. Wiley, J., and Sons, Science (after James D. Dana). 3. Kerr, P. F., Hill, Graw, M. C., 1959. <i>Optical Mineralogy</i>. 4. Verma, P. K., 2010. <i>Optical Mineralogy (Four Colour)</i>. Ane Books Pvt Ltd. 5. Deer, W. A., Howie, R. A., and Zussman, J., 1992. <i>An Introduction to the Rock-Forming Minerals (Vol. 696)</i>. London: Longman. 6. Jensen, M. L., and Bateman, A. M., <i>Economic Mineral Deposits</i>. John Wiley & Sons.

Course Title:	Geology Lab Mineral Science	Course Code: 24BGL5201P
	1. Representation of crystal models with respect to axis, symmetry, and forms. 2. Identification and description of rock-forming minerals in hand specimens: Quartz, Feldspar, Muscovite, Biotite, Hornblende, Augite, Olivine, Garnet, Kyanite, Tremolite, Tourmaline, Beryl, Nepheline, Fluorite, and Corundum. 3. Microscopic identification of minerals: Olivine, Pyroxene, Garnet, Feldspar, Biotite, Muscovite. Scheme of pleochroism and absorption of a given mineral in thin section. 4. Identification and description of important ore minerals and rocks in hand specimens. Plotting of important economic mineral deposits in the outline map of India.	
Reference Books:		
	1. Berry, L. G., Mason, B., and Dietrich, R. V., 1985. <i>Mineralogy: Concepts, Descriptions and Determinations</i>. CBS. 2. Dana, E. S., and Ford, W. E., 2002. <i>A Textbook of Mineralogy (Reprint)</i>. 3. Deer, W. A., Howie, R. A., and Zussman, J., 2013. <i>An Introduction to the Rock-Forming Minerals</i>, ELBS. 4. Gribble, C. D., 2005. <i>Rutley's Elements of Mineralogy</i>, Springer. 5. Kerr, P. F., and Hill, Grew, M. C., 1977. <i>Optical Mineralogy</i>. 6. Nesse, D. W., and Hill, Grew, M. C., 1986. <i>Optical Mineralogy</i>. 7. Perkins, D., 2013. <i>Mineralogy</i>, Prentice Hall. 8. Phillips, F. C., 1971. <i>Introduction to Crystallography</i>, Longman Group.	

Semester – III

Learning Objectives

- Understand the fundamentals of sedimentary processes and stratigraphic correlation.
- Understand magma generation and evolution, and classification of igneous rocks.
- Understand factors of metamorphism, and classify metamorphic rocks.

- Understand the basic concept of petrology and understand the formation and types of mineral deposits associated with rocks.

Course Title:	Petrology and Ore Genesis	Course Code: 24BGL6301T
Total Lecture hour 45		
Unit I	Sedimentary Petrology: Definition and scope. Sediments: origin, transportation, deposition, and lithification. Fabric and texture of sedimentary rocks. Roundness of particles and their geological significance. Major sedimentary structures - primary, secondary, and biogenetic and their significance. Classification of sedimentary rocks. Types of arenites, carbonate rocks, and argillites.	15
Unit II	Igneous Petrology: Magma: Definition, origin, chemical composition, and constituents. Crystallization of magma: Bowen's reaction series, magmatic differentiation, and assimilation. Forms and structures of extrusive and intrusive igneous rocks. Igneous textures: crystallinity, grain shape, size, and mutual relationship of grains. Classification and types of igneous rocks. Petrogenesis of important rock types: granite, diorite, syenite, gabbro, rhyolite, basalt, trachyte, and pegmatite.	10
Unit III	Metamorphic Petrology: Introduction to metamorphic rock and its significance. Factors of metamorphism. Classification of metamorphic rocks. Basic concepts of types of metamorphism, concepts of isograds and zones of metamorphism. Relationship between metamorphism and deformation. The texture of metamorphic rocks. Petrogenesis of important metamorphic rocks: Quartzite, Marble, Slate, Phyllite, Schist, Gneiss, and Granulite.	12
Unit IV	Primary Ore Genesis Processes: Magma and its relation with mineral deposits. Elementary ideas of magmatic concentration and hydrothermal processes. Secondary Ore Genesis Processes: Elementary ideas of processes of ore formation by sedimentation, volcanogenic, evaporation, oxidation and supergene enrichment, metamorphism, mechanical, and residual concentration.	8

Course Title:	Geology Lab Petrology and Ore Genesis	Course Code: 24BGL6301P
1. Handling of petrological & ore microscope. 2. Under a microscope, identification of important rocks and ores. 3. Identification of some common igneous rocks (Granite, Granodiorite, Syenite, Diorite, Norite, Gabbro, Pyroxenite, Peridotite, Nepheline Syenite, Pegmatite, Dolerite, Basalt, and Rhyolite) in hand specimen with particular emphasis on texture and structures. 4. Identification of some common sedimentary rocks (Sandstone, Limestone, Shale, Conglomerate, Arkose, Grit, Greywacke, and Breccia) in hand specimens with particular emphasis on texture and structures. 5. Identification of some common metamorphic rocks (Quartzite, Marble, Granite Gneiss, Mica Schist, Phyllite, Slate, Amphibolite, Charnockite, Mylonite, and Migmatitic Gneiss) in hand specimens with particular emphasis on texture and structures. 6. Identification of some important ore minerals (Hematite, Chalcopyrite, Pyrite, Cuprite, Magnetite, Chromite, Arsenopyrite, Galena, Sphalerite, Pyrrhotite, Bauxite, Magnesite, and other important ore minerals (metallic		

and non-metallic) in hand specimens with particular emphasis on texture and structure.

Reference Books:

1. John, O. Winter, *Principles of Igneous and Metamorphic Petrology*, Pearson.
2. Singh, Parbin, Kataria, S. K. and Sons, *Engineering & General Geology*, New Delhi.
3. John, Petti, *Sedimentary Rocks*.
4. Paul F. Kerr, *Optical Mineralogy*.
5. Tyrell, G. W., *The Principles of Petrology*.
6. Shrivastava, J. P., *Introduction to Ore Microscope*.
7. Bernhard, Precejus, *The Minerals under the Microscope, An Optical Guide (ISSN Book 3)*, 1st Edition.

Semester – IV

Learning Objectives

- Understand the formation and origin of different types of rocks.
- Understand the handling and work process of petrological & ore microscope
- Understand the texture and structure of various rock types in hand specimens as well as under the microscope.
- Understand the basic concept of petrology and understand the formation and types of mineral deposits associated with rocks.

Course Title:	Palaeontology and Stratigraphy	Course Code: 24BGL6401T
Total Lecture hour 45		Hours
Unit I	Fundamentals of Palaeontology and Stratigraphy: Definition of Palaeontology and its relationship with allied subjects. Fossils: Modes of preservation and uses. Principles of stratigraphy. Stratigraphic classification and correlation. Geomorphologic divisions of India and their stratigraphic features.	12
Unit II	Important Fossils I: Morphology and geological distribution of Foraminifera, Graptoloidea, Echinoidea, and Trilobita.	10
Unit III	Important Fossils II: Morphology and geological distribution of Gastropoda, Pelecypoda, Brachiopoda. Evolutionary history of Man.	11
Unit IV	Precambrian Stratigraphy: Geological Time Scale and its equivalent formations of India. Stratigraphy of major Precambrian Protocontinents of India: Dharwad (including Cuddapah and Kurnool), Singhbhum, Bundelkhand (including Vindhyan), Aravalli. Phanerozoic Stratigraphy: Stratigraphy of Phanerozoic of India: Palaeozoic of Himalayan Terrane, Gondwana (including plant fossils), Siwaliks (including vertebrate fossils). Mesozoic and Cenozoic of Nutch, Spiti, Rajasthan, Trichinopoly, and Assam.	12
Reference Books:		
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. 8. S. Publication, New Delhi.
5.	Mishra RP 'Jeevashm Vigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.
6.	P. C. Jain and M.S. Anantharaman: Palaeontology Evolution and Animal Distribution. Vishal Publications.
7.	Shrock R. P. and Twenhofel V. H. : Principles of Invertebrate Palaeontology. CBS.
8.	Roy A. B. & Jakhar S.R. 2002: Geology of Rajasthan (Northwest India) Precambrian to Recent. Scientific Publishers (India), Jodhpur.
9.	Amal Dasgupta, 2010. Phanerozoic Stratigraphy of India. The World Press Pvt. Ltd. Kolkata.
10.	Roy A.B. & Ritesh Purohit R., 2018. Indian Shield,

Course Title:	Geology Lab Paleontology and Stratigraphy	Course Code: 24BGL6401P
Identification and description of the following fossils in hand specimens:		
1.	Foraminifera: Nummulites, Assilina, Alveolina.	
2.	Echinoidea: Cidaris, Hemiaster, Micraster.	
3.	Brachiopoda: Rhynchonella, Terebratula, Productus, Spirifer.	
4.	Pelecypoda: Pecten, Ostrea, Trigonina, Lima, Exogyra.	
5.	Gastropoda: Trochus, Murex, Voluta, Physa, Turritella, Conus.	
6.	Ammonoidea: Phylloceras, Ceratites, Perisphinctes.	
7.	Coleoidea: Belemnites.	
8.	Nautiloidea: Nautilus, Orthoceras.	
9.	Trilobita: Calymene, Phacops, Agnostus, Trinucleus, Paradoxides.	
10.	Graptoloidea: Monograptus, Diplograptus.	
11.	Plant Fossils: Glossopteris, Gangamopteris, Vertebraria, Ptilophyllum.	
Stratigraphy:		
1.	Identification and description of important stratigraphic rocks of India and their assignment to the respective stratigraphic position.	
2.	Plotting of the following stratigraphic units and their equivalents in the outline map of India: Delhi-Aravalli fold belts, Main Vindhyan Basin, Gondwana Supergroup, Deccan Traps, and Siwalik Group.	
3.	Preparation of palaeogeographic maps of Permo-Carboniferous and Cretaceous periods.	

Reference Books:	
1.	Bharatvarsh Ka Bhu Vigyan : Madhya Pradesh Hindi Granth Academy. Bhopal.
2.	Krishnan M S: Geology of India and Burma, C. B. S. Publication, New Delhi.
3.	Mishra RP 'Jeevashm Vigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.
4.	P. C. Jain and M.S. Anantharaman: Palaeontology Evolution and Animal Distribution.
5.	Shrock R. P. and Twenhofel W.H.: Principles of Invertebrate Palaeontology. CBS.
6.	Roy A. B. & Jakhar S.R. 2002: Geology of Rajasthan (Northwest India) Precambrian to Recent. Scientific Publishers (India), Jodhpur.
7.	Amal Dasgupta, 2010. Phanerozoic Stratigraphy of India. The World Press Pvt. Ltd. Kolkata.

Semester – V**Photogeology and Remote Sensing****Course Objectives:**

1. To understand the aerial photography and Preparation of Photo-geologic Maps. Mosaic controlling factors of aerial photograph.
2. To know about Electro-Magnetic Spectrum, Space platforms and Elementary idea about active and passive sensors.
3. Application of photo-geology and remote sensing in geological studies
4. To impart knowledge of environmental geology, natural hazards and basic concepts of remote sensing and GIS Photogeology

Course Title:	Photogeology and Remote Sensing	Course Code: 24BGL7501T
Total Lecture hour 45	Hours	
Unit I	Definition and Scope of Remote Sensing in Geology, Electromagnetic Spectrum – Definition and Components. Energy sources and radiation – Outline of Interaction of Electromagnetic Spectrum with Atmosphere and Earth surface features – Spectral Signatures – Atmospheric Windows..	12
Unit II	Types of Remote Sensing: Based on 1) Energy sources: Active and Passive. 2) Platforms: Aerial and Satellite and 3) Sensors: Optical, Thermal, and Microwaves. 4) RADAR. Aerial Remote Sensing – Types of Aerial Photographs: Vertical and Oblique. Scale of Aerial Photographs – Flight Procedures. Stereoscopes: Pocket and Mirror Stereoscopes.	10
Unit III	Photo Interpretation Elements. Mosaics: Controlled and Uncontrolled Mosaics – Advantage and Disadvantages – Application of Mosaics in Geology Studies. Satellite Remote Sensing: Principles of Optical Remote Sensing: Satellite Orbiting Mechanisms – Brief account of Multi Spectral Scanning – Along track and across track scanings. Types of Resolution – Data Acquisition and Interpretation. REMOTE SENSING	12
Unit IV	Aerial Photography: Types of Aerial Photographs, Geometry of Aerial Photographs: Oblique, Vertical and Stereopair. Scale of Photograph: Determination of scale-Relief displacement – Stereoscopes-Parallax bar. Thermal Remote Sensing: Thermal Radiation Principles – Atmospheric Windows – Advantages and Disadvantages. SLAR – Principle and Applications. A short account of LANDSAT, SPOT, India Remote Sensing Satellites and Indian Space Missions.	12
Suggestive Readings:		
1. Curran, P.B. (1985), Principles of Remote Sensing, ELBS, London. 2. Drury, S.D. (1993), Image Interpretation in Geology, Allen & Unwin, London. 3. Miller, V.C. (1961), Photogeology McGraw Hill, New York. 4. Pandey, S.N. (1993), Principles and Applications of Photogeology, Wiley Eastern, Delhi. 5. Sabins, F.F. (1974), Remote Sensing Principles and Interpretation, Freeman, New York. 6. Reddy, M.A. (2010), Principles of Remote Sensing and GIS, CBS, Delhi. 7. Gupta, R.P. (2003), Remote Sensing Geology, Springer, New Delhi. 8. Lillisand, T.M. & R. W. Kiefer (2000), Remote Sensing and Image Interpretation, Wiley, B.S		

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Course Title:	Geology Lab	Course Code: 24BGL7501P
- Introduction of GIS, Projection and Reprojection, Georeferencing: Toposheet and Image Registration, Digitization of Toposheet, Map Preparation or Map Layout. - To learns basic of aerial remote sensing and its applications - Understand the application of Satellite Science. - Analyse various Physiographical features through GIS. - To understands the physics of electromagnetic spectrum and learn satellite remote sensing.		

Semester – VI
Mining and Economic Geology

Course Objectives:

- To understand the basic fundamental concepts of various mining methods, their terminologies, and the type of sampling adopted, explosives used in the mine, and to have a basic knowledge about mine machineries.
- To learn about the process of formation, classification, significance, and distribution of ore deposits and their use.

Course Title:	Mining and Economic Geology	Course Code: 24BGL7601T
Total Lecture hour 45		Hours
Unit I	Sampling-Principles - Types- Collection of sample-Core Sample and their Preservation. Mining Terminology: Exploitation-Development-Shaft, Level, Adit, Hanging Wall, Foot wall, Drive, Cross-Cut, Tunnel, Raise, Winze and Chute.	12
Unit II	Economic Geology, developments and its relationship with various branches of Geology. Ore and gangue minerals. Ore forming Processes with special reference to Magmatic, Hydrothermal, Mechanical and Residual concentration.	12
Unit III	Classification of mineral deposits: outlines of Lindgren's and Bateman's classification. Important ores, composition, physical properties, mode of occurrence and distribution in India of the following metal deposits; gold, silver, copper, lead-zinc, iron, manganese, chromium and aluminium.	11
Unit IV	Important industrial minerals: Mode of occurrence, physical properties, chemical composition and distribution in India; Abrasives, Ceramics, Cement, Gemstones, Glass, Paint and Fertilizers. Strategic, Critical & essential mineral. Coal, petroleum and radioactive minerals; their occurrences, distribution and origin-oil traps.	10

Suggestive Readings:

- Batman, A.M.: Introduction to economic mineral deposits.
- Wadia, M.D. Minerals of India, Book Trust of Publ.
- Rao, T.C. and Gokhle, K.V.G.K.: Ore deposits of India, their distribution and processing.
- Krishna Swamy, S.: India's Economic Oxford & I.B.H. Publishing Co., New Delhi.
- Prasad U.: Economic Geology, CBS Publisher, Delhi.

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6. Robb L.: Introduction to Ore Forming Processes, Wiley-Blackwell.

Course Title:	Geology Lab	Course Code: 24BGL7601P
• Mining Methods and Various Mining Terminology • Plane Table Survey • Diagram Depicting the Touring • Gosso Oxidation Zone and Supergene Enrichment Zone • Structural Traps for oil Accumulation • Systematic study, identification, description, mode of occurrences and uses of the following Minerals – Hematite, Magnetite, Siderite, Pyrites, Pyrolusite, Psilomelane , Chromite , Ilmenite, Chalcopyrite, Malanite, Azurite, Galena, Sphalerite, Magnesite, Beausite, Beryl, Stibnite,, Barite, Muscovite, Graphite, Kyanite, Garret, Corundum, Gypsum, Talc, Apatite, Rock Phosphate, Calcite, Coal. And its Varities • In an outline map of India Plot occurrence of the following Mineral Deposits: Copper Lead-Zinc, Silver, Gold, Chromite, Manganese Mica, Iron, Coal. And Diamond		

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