UNIVERSITY OF KOTA, KOTA

Syllabus of Geology

for

Three-Year Undergraduate (B.Sc.) Program
as per the Choice Based Credit System (CBCS)
designed in accordance with
Learning Outcomes-Based Curriculum Framework (LOCF) of
National Education Policy (NEP-2020)

I to VI Semester B.Sc. with Geology Courses
for Academic Year 2025-26
(Effective from the Academic Year 2025-26)

Faculty of Science
UNIVERSITY OF KOTA, KOTA

UNIVERSITY OF KOTA, KOTA

Structuring of Courses in B.Sc. Geology Program from Semester – I to VI (2023-26)

Sem.	Course Type	Course Code	Course Title	Duration of Exam	Teaching Hrs. Week and Credit			Distribution of Marks			Minimum Passing Marks	
					L	P	C	Internal Asses.	Semester	Total	Inter.	Sem.
I	DCC	GEO1.1T	Geology- I Earth System Science	3 Hrs.	4	-	4	30	70	100	12	28
		GEO1.2P	Geology Practical - I	6 Hrs.	-	4	2	--	50	50	--	25
II	DCC	GEO2.1T	Geology- II Mineral Science	3 Hrs.	4	-	4	30	70	100	12	28
		GEO2.2P	GeologyPractical – II	6 Hrs.	-	4	2	--	50	50	--	25
Option for Exit with Certificate												
III	DCC	GEO3.1T	Geology- III Petrology	3 Hrs.	4	-	4	30	70	100	12	28
		GEO3.2P	Geology Practical – III	6 Hrs.	-	4	2	--	50	50	--	25
IV	DCC	GEO4.1T	Geology- IV Stratigraphy	3 Hrs.	4	-	4	30	70	100	12	28
		GEO4.2P	Geology Practical – IV	6 Hrs.	-	4	2	--	50	50	--	25
Option for Exit with Diploma												
V	DSE (Choose any One Paper)	GEO5.1T	Geology- V Structure Geology	3 Hrs.	4	-	4	30	70	100	12	28
		GEO5.2T	Geology- VI Palaeontology									
		GEO5.3T	Geology- VII Hydrogeology									
		GEO5.4P	Geology Practical – V	6 Hrs.	-	4	2	--	50	50	--	25
VI	DSE (Choose any One Paper)	GEO6.1T	Geology- VIII Economic Geology	3 Hrs.	4	-	4	30	70	100	12	28
		GEO6.2T	Geology- IX Mineral Exploration and Mining									
		GEO6.3T	Geology- X Geology and Minerals of Rajasthan									
		GEO6.4P	Geology Practical – VI	6 Hrs.	-	4	2	--	50	50	--	25
ExitwithB.Sc.Degree												

Note:Here DCC – Discipline Centric Core Course; DSE -Discipline Specific Elective Course; SEC - Skill Enhancement Course; L–Lecture; P- Practical; C – Credit. In V and VI semester the student will choose any one of the DSE subject.

B.Sc. I Semester, Geology 2025 – 2026

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 andlandforms. 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 ofhydrosphere, 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 ofpalaeomagnetism.

Unit III

Geomorphic agents and processes: Weathering – their types, Erosional processes. Difference betweenWeathering 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 2025 – 2026

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 differentcrystals and rock forming minerals , crystal structure, physicochemical and optical propertiesof mineralsusful in their identification.

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

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, OrthorhombicandHexagonal System.

Unit II

Ordinary and polarized light, isotropic and anisotropic minerals,Reflection and refraction of light, Refractive index, critical angle, Becke'seffect, 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 ofIsomorphism 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 2026 – 2027

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, evolutionand 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, MineralogicalandGeochemical parameters. Tabular classification of Igneous rocks. Megascopic and microscopic characteristicsand 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. Textureand structures of metamorphic rocks. Introduction to cataclastic, thermal, and dynamo-thermalmetamorphism 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 petrogenesisof common sedimentary rocks: Arkose, Sandstone, Siltstone, Shale, Conglomerate, Breccia, Limestone, Dolomite and Phosphorite. Elementary knowledge of sedimentary environments. Characteristicsof 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 2026 – 2027

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 ofStratigraphy. Geological Time Scale. Law of Superposition. Chronological (Timeunit), Geochronological(TimeRockunit) 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, CuddapahSupergroup, Delhi Supergroup, and Vindhyan Supergroup.Erinpura Granites and Sirohi Group, MarwarSupergroup 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 ofTrichinopoly. Gondwana Supergroup and Deccan Traps.

Unit V

Tertiary Rocks of Asam, Rajasthan (Barmer, Jaisalmer and Bikaner - NagaurBasins) and Kachchh. SiwalikSupergroup. 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

B.Sc. V Semester, Geology 2027 – 2028

Discipline Specific Elective Course – Geology – V
Theory Paper (GEO5.1T) – Structural Geology
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objectives:
This course proposes an objective to educate the students about the concept of Structural Geology and outline of the basic geological structures and structural analysis.

Course Outcomes:
Upon successful completion of course the students would be able to understand:
Measurement of attitudes of rocks, techniques of geological mapping and different structures viz: Fold, Faults, Joints, Cleavages and Lineation; Varios types of folds,faults and their mechanisms.

Unit I

Basic concepts of Structural Geology. Concept of bed. Attitude of planar and linear structures. True dip, Apparent dip, Strike. Clinometer compass and its application. Geological Map: Definition and its Components. Field techniques of lithological andstructural mapping; study of toposheet, V-rule and outcrop patterns; Stereographic projection ofstructural elements and its importance. Primary sedimentary structures, their use in determination of topand bottom of beds.

Unit II

Fold: Parts of folds. Geometric and genetic classifications of Folds, Mechanism of folding. Recognitionof folds in map and field. Significance of Folds.

Unit III

Introduction to Stress and Strain. Strain and its types; Compressive and shear stress; Mean anddeviatoric stress; Relationship between stress and strain.Faults: Parts of faults. Classifications of fault. Effect of Faulting on outcrops. Recognition of faults inmap and field. Slickensides and Drag folds. Significance of Faults.

Unit IV

Joints: Characteristics and Types. Significance of Joints and Fractures. Cleavage and their Classification; Relation of cleavages to deformation & major structures. Schistosity.Unconformities: types andrecognition.

Unit V

Lineation and Foliation: Introduction and types. Slickenside; boudinage, mineral streaks, roddingand mullionstructures and their mode of development. Significance of lineation andFoliation. Dome and Basin, Outlier, Inlier, Overlap and Offlap structures.

Books Recommended:
1. Bhattacharya, A. R. (2022). Structural Geology, Springer, 468p.
2. Ghosh, S.K. (1993): Structural Geology- Fundamental & Modern Development. Pergamon Press.
3. Billing, M.P. (1974): Principle of Structural Geology. Prentice Hall Int. Inc.

4. Nevin C.M. : Principles of Structural Geology. John Wiley & Sons
5. Hobbs B. E., Means W. D. and Williams P. F. : An outline of Structural Geology. John Wiley & Sons.
6. Jain, A. K. (2014): Structural Geology, Geol. Soc. of India, Bangalore.

Discipline Specific Elective Course – Geology – VI
Theory Paper (GEO5.2T) – Paleontology
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objectives:
1. To impart basic knowledge about Palaeontology.
2. To acquaint with morphology of common invertebrate fossil groups.

Course Outcomes: Upon successful completion of course the students would be able to
1. Understand the basic concept of Palaeontology.
2. Understand fundamentals of vertebrates and invertebrates.
3. Understand fossils and their significance in geological science.

Unit I

Definition, subdivisions of Palaeontology and its relation with allied subjects. Fossils, and their modesof preservation. Uses of fossils. Elementary ideas of organic evolution. Introduction to Classificationand Nomenclature of Animal Kingdom. Morphology of hard parts, environment and geological distribution of Brachiopoda.

Unit II

Study of morphology, environment and geological distribution of Graptoloidea, Echinoidea andAnthozoa (Corals).

Unit III

Study of the morphology of hard parts and geological distribution of Gastropoda, Pelecypoda andTrilobita.

Unit IV

Morphology, environment and geological distribution of Cephalopoda (Ammonoidea,Nautiloidea and Dibranchia) and Foraminifera.

Unit V

Introduction to Gondwana flora and vertebrates of Siwaliks of India. Evolutionary history of Man and Horsein brief.

Books Recommended:

1. Amal Dasgupta, 2012. An Introduction to Palaeontology. The World Press Pvt. Ltd. Kolkata.
2. Woods, H., 1985: 'Invertebrate Palaeontology' CBS Publishers and Distributions.
3. Mishra R P 'JeevashmVigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.
4. P. C. Jain and M.S. Anantharaman: Palaeontology Evolution and Animal Distribution. VishalPublications.
5. Shrock R. P. and TwenhofelW.H. : Principles of Invertebrate Palaeontology. CBS.
6. Moore R. C., Lalicher C.G. and Fisher A.C.: 'Invertebrate fossils'. McGraw Hill.
7. Kathal, P.K.: Microfossils & their applications. Scientific Publishers, Jodhpur.

Discipline Specific Elective Course – Geology – VII
Theory Paper (GEO5.3T) – Hydrogeology
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objectives:
1. To impart basic knowledge about hydrogeology.
2. To acquaint with hydrogeological properties of rocks, groundwater flow, groundwater pollution and groundwater management.

Course Outcomes: Upon successful completion of course the students would be able to
1. Understand the basic concept of hydrogeology.
2. Understand the issues related to groundwater management and conservation.

Unit I

Introduction and importance of groundwater. Sources of groundwater and origin, hydrological cycle. Hydrological properties of rock: Types of aquifers, porosity, permeability, transmissibility, storage coefficient specific yied and specific retention. Water table and artesian well.

Unit II

Theory of groundwater flow, Darcy's law and its application. Types of wells, collector wells and infiltration galleries. Groundwater draft and recharge. Groundwater level and its fluctuation. Occurrence of groundwater in igneous, metamorphic and sedimentary rocks.

Unit III

Groundwater Exploration: Gophysical methods, Seismic methods, Electric resistivity methods. Application of remote sensing in groundwater exploration. Concept of groundwater conservation and management. Water Table contour maps.

Unit IV

Physical, chemical and microbiological parameters of groundwater. Water quality standards for drinking, irrigation and industrial purposes. Groundwater pollution, effect of microbiological and chemical impurities on human health. Impact of solid and liquid waste disposal on water quality. Saline and fresh water interface.

Unit V

Artificial recharge: need and benefits, method of artificial recharge including rain water harvesting. Groundwater provinces of India with special reference to Rajasthan. Groundwater potential of Rajasthan. Water salinity, fluoride and water-logging issues in Rajasthan.

Recommended Books:

Alley, W.M., 1993: Regional Groundwater Quality. VNR, New York
Black, W.& Others (ED.), 1989: Hydrogeology. Geol. Soc. Of America Publ.
Davies, S.N. & De Wiest, R.J.M., 1966: Hydrogeology. John wiley
Freeze, R. A. & Cherry, J.A., 1979: Groundwater. Prentice Hall
Karanth, K.R., 1987: Groundwater Assessment – Development and Management. Tata McGraw Hill
Raghunath, N.M., 1982: Groundwater. Wiley Eastern
Subramaniam, V., 2000: Water. Kingston Publ. London
Todd, D.K., 1980: Groundwater Hydrology. John Wiley

Discipline Specific Elective Course
Practical – V (GEO5.4P) – Structure Geology
50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Use of Clinometer Compass.
- Study of topographic maps. Interpretation of topography from contour maps.
- Stereographic projection: Problems in angular relationships-true dip, apparent dip, plunge and pitch.
- Interpretation of geological maps and preparation of cross section of geological maps.

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

Discipline Specific Elective Course
Practical – V (GEO5.4P) – Paleontology
50 Marks, Credits 2 **Exam Duration: 6 Hours**

Identification and description of following fossils in hand specimens with their labelled drawings:

- Corals :*Calceola and Zaphrentis*
- Echinoidea :*Cidaris, Hemiaster, Micraster*.
- Brachiopoda :*Rhynchonella, Terebratula, Productus, Spirifer*.
- Pelecypoda :*Pecten , Lima, Ostrea, Trigonia*
- Gastropoda :*Murex, Physa, Turritella and Cyprea*.
- Ammonoidea :*Goniatites, Phylloceras and Ceratites*.
- Coleoidea :*Belemnites*.
- Nautiloidea :*Nautilus*
- Trilobita :*Calymene, Phacops, Paradoxides*.
- Graptoloidea :*Monograptus, Diplograptus*.
- Foraminifera :*Nummulites, Assilina, Alveolina.*
- Plant fossils :*Glossopteris, Gangmopteris, Vertibraria, Ptilophyllum*.

Draw Morphological Charts of Echinoids, Brachiopods, Pelecypod, Cephalopods, Trilobite, and Graptoloids.

Draw evolutionary charts of Horse and Man.

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

Discipline Specific Elective Course
Practical – V (GEO5.4P) – Hydrogeology

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

- Draw the groundwater provinces of India and Rajasthan in the physical maps.
- Calculation and exercises on groundwater quality, exploration, yield, recharge, water table fluctuation etc.
- Preparation of iso-concentration maps of water quality parameters.
- Schematic representation of artificial recharge structures.

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	:	10 marks

B.Sc. VI Semester, Geology 2027 – 2028

Discipline Specific Elective Course – Geology – VIII
Theory Paper (GEO6.1T) – Economic Geology
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
The course is aimed to impart knowledge about ore forming processes; occurrences and distribution ofeconomic mineral deposits in India and their uses.

Course Outcomes:
Upon successful completion of course the students would be able to:
1. Understand the basic concept of mineral forming processes, and their classification.
2. Understand Mineral deposits distribution in India and their uses.

Unit I

Introduction and definitions of important terms related to Economic Geology. Classification of Ore Forming Processes.Ore forming process and deposits: Magmatic Concentration, Contact metasomatism(including Skarns), Hydrothermal process,

Unit II

Ore forming process and deposits: Sedimentation (Chemical Precipitation and Evaporation), Weathering (Residual and Mechanical Concentration), Oxidation and Supergene sulphide enrichment.Volcanogenic, Metamorphic and Biogenic Process.

Unit III

Geological setup, distribution and economic aspects of Gold deposits, Lead Zinc and Copper deposits, Iron and manganese deposits, Aluminium, Chromium, Tinand Tungsten deposits of India.

Unit IV

Description of industrial minerals used in Cement, Fertilizer, Refractory, Abrasive, Glass and Ceramics, Paint and Pigments, Insulator and Electronic industries.Gem Stones and Building Stones (Sandstone, Limestone, Marble and Granite).

Unit V

Energy Minerals: (A) Coal: Origin of coal, Classification of coals, ranks of coal. Indian coal fields (B) Petroleum: Origin of Petroleum. Important oil and gas fields of India. (C) Nuclear Minerals: Geology and distribution of atomic minerals in India.

Books Recommended:

1. Umeshwar Prasad 2008. Economic Mineral Deposits. CBS Publishers and Distributors.
2. Pramod O Alexander, 2009 : A Handbook of Minerals, Crystals, Rocks and Ores. Published by New India Publishing Agency
3. Chandra D. and Singh R.M., 2003. Petroleum Geology (Indian Context) , Tara Book Agency, Varanasi.
4. D. Chandra, R.M. Singh and M.P. Singh. Text Book of COAL (Indian Context) by (Tara Book Agency, Kamachha, Varanasi – 221010.
5. Deb S. : Industrial Minerals and Rocks.
6. Jensen M. L. & Bateman A. M. : Economic Mineral Deposits. John Wiley & Sons.

Discipline Specific Elective Course – Geology – IX
Theory Paper (GEO6.2T) – Mineral Exploration and Mining
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
The course is aimed to impart knowledge about prospecting and exploration of mineral resources and different mining methods.

Course Outcomes:
Upon successful completion of course the students would be able to:
1. Understand the basic concept of mineral exploration techniques
2. Understand the various processes of open cast and underground mining.

Unit I
Guides for locating ore deposits: structural, lithological, stratigraphic and physiographic guides. Surface prospecting methods: pitting and trenching; Sub-surface exploration: drilling, different types of drilling and their uses. Core-logging and assaying;

Unit II
Sampling: various methods of sampling.Ore reserves and resources: definition and outline of United Nations International framework classification of mineral reserves and resources; grades and recovery of ores; methods of ore reserve estimations.

Unit III
Outline of geophysical and geochemical prospecting; role of remote sensing in mineral exploration. Explosives: types, storage and precautions in handling of explosives. Blasting: various patterns of blast holes and methods of their charging and blasting.

Unit IV
Elements of mining: mining methods; various types of surface and underground mining methods; factors involving in selection of open cast and underground mining methods; salient features of bench-mining, shrinkage stopping, sub-level stopping and sub-level top slicing; coal mining methods: room and pillar method, long wall method.

Unit V
Outlines of the rules governing conservation, development and utilization of mineral resources; National mineral policy; prospecting license and mining lease; procedures of granting prospecting license and mining lease. Environmental aspects of Mining activities.

Recommended Books:
Dobrin, M. B., 1976: Introduction to Geophysical Prospecting. McGraw Hill
Arogyaswami, R.P.N., 1996: Courses in Mining Geology. IV Ed. Oxford IBH
Boyle, R.W., 1982: Geochemical Prospecting for Thorium and Uranium Deposits. Elsevier
Clark, G.B., 1967: Elements of Mining. III Ed. John Wiley

Discipline Specific Elective Course – Geology – X
Theory Paper (GEO6.3T) – Geology and Mineral Resources of Rajasthan
100 Marks, Credits 4 **Exam Duration: 3 Hours**

Course Objective:
The course is aimed to impart knowledge about various geological formations of Rajasthan along with the mineral resources of the state.

Course Outcomes:
Upon successful completion of course the students would be able to:
1. Understand the general stratigraphy of Rajasthan
2. Understand the distribution of different metallic, non- metallic and fuel mineral resources of Rajasthan.

Unit I

Geomorphologic division of Rajasthan and their characteristic. Geology Time Scale and its equivalents in Rajasthan. Banded Gneissic Complex, Aravalli and Delhi Supergroups, their distribution, classification, lithology, economic importance and igneous intrusive.

Unit II

Younger Precambrian formations of Rajasthan. Sirohi group, Sindhrath Group and Malani Igneous Suite, Vindhyan and Marwar Supergroups of Rajasthan, their distribution, classification, lithology, fossil content and economic importance.

Unit III

Palaeozoic, Mesozoic, Tertiary and Quaternary geological of Rajasthan, their distribution, classification, lithology, fossil content and economic importance.

Unit IV

Metallic and fuel (lignite, oil and gas) mineral deposits in Rajasthan with reference to their geographic and geologic distribution mode of occurrence and origin.

Unit V

Study of non – metallic (fertilizer minerals, refractory minerals, glass and ceramic minerals, abrasives, gemstones, cement) minerals and building stones of Rajasthan with reference to their geographic and geologic distribution mode of occurrence and origin.

Recommended Books:

1. Ramakrishnan M. &Vaidyanadhan R., 2010. Geology of India, Vol-I and Vol-II, Geol. Soc. India, Bangalore.
2. Krishnan M S : Geology of India and Burma, C. B. S. Publication, New Delhi.
3. Roy A. B. & Jakhar S.R. 2002 : Geology of Rajasthan (Northwest India) Precambrian to Recent. Scientific Publishers (India), Jodhpur.
4. Agrawal, V., Kapasya, H. and Sen, H. (2023), Introduction to Geology, Raghav Publication, New Delhi
5. Parbin Singh: Engineering and General Geology, S.K. Kataria & Sons, New Delhi
6. Website of Department of Mines & Geology, Rajasthan
7. Mineral Year Book, Indian Bureau of Mines, Nagpur

Discipline Specific Elective Course
Practical - VI (GEO6.4P) – Economic Geology
50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Physical properties, distribution and economic uses of Metallic minerals (ores). Galena, Sphalerite, Chalcopyrite, Limonite, Magnetite, Hematite, Pyrolusite, Psilomelane, Bauxite, Chromite, Wolframite, Pyrite, Malachite and Azurite.
- Physical properties, distribution and uses of Non Metallic minerals like Petroleum and Coals, Phosphorite, Gypsum, Diamond, Kyanite, Magnesite, Garnet, Corundum, Quartz, Feldspar, Asbestos, Wollastonite, Talc, Fluorite, Barite, Muscovite, Ocher, Graphite.
- Preparation of map showing distribution of important economic deposits in India and Rajasthan.

Discipline Specific Elective Course
Practical - VI (GEO6.4P) – Mineral Exploration and Mining
50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Survey by Plane Table, Levelling and Use of Brunton and GPS.
- Diagrammatic representation of different mining methods including opencast bench mining, sub-level stopping, shrinkage stopping, sub-level top slicing, room and pillar method.
- Calculation exercises of ore reserve estimations.

Discipline Specific Elective Course
Practical - VI (GEO6.4P) – Geology and Minerals of Rajasthan
50 Marks, Credits 2 **Exam Duration: 6 Hours**

- Identification of texture, structure, mineral composition, location and geological age of important rocks of Rajasthan in hand specimen.
- Representation of distribution of important geological formations in the map of Rajasthan.
- Identification, chemical composition and uses of important metallic, non – metallic minerals and building stones of Rajasthan.
- Representation of distribution of metallic, non – metallic minerals and building stones in the map of Rajasthan.

Distribution of Marks in Practical Exam:

Practical Exercises	:	30 marks
Viva – voce	:	10 marks
Record	:	10 marks