

Deccan Education Society's
FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY
THIRD YEAR B.Sc. (GEOLOGY)
SEMESTER - V

**Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004
Scheme of Course Structure (Faculty of Science)
2018-2019
T. Y. B. Sc. - Geology**

Semester	Course Code	Title	Paper No.	Credits	Exam (I / E)	Marks (50 / 50)
V	GLY3501	Mineralogy, Optics and Crystallography	Theory Paper - 1	3	I / E	50 / 50
	GLY3502	Structural Geology and Tectonics	Theory Paper - 2	3	I / E	50 / 50
	GLY3503	Precambrian Stratigraphy of India	Theory Paper - 3	3	I / E	50 / 50
	GLY3504	Geomorphology, Remote Sensing & Field Geology	Theory Paper - 4	3	I / E	50 / 50
	GLY3505	Engineering Geology	Theory Paper - 5 (A)	3	I / E	50 / 50
			OR			
	GLY3506	Principles of Geochemistry	Theory Paper - 5 (B)	3	I / E	50 / 50
	GLY3507	Quaternary Geology and Palaeoclimate	Theory Paper - 6 (A)	3	I / E	50 / 50
			OR			
	GLY3508	Basics of Geophysics and Geophysical Prospecting	Theory Paper - 6 (B)	3	I / E	50 / 50
	GLY3511	Geology Practical - I	Practical Paper - I	2	I / E	50 / 50
	GLY3512	Geology Practical - II	Practical Paper - II	2	I / E	50 / 50
	GLY3513	Geology Practical - III	Practical Paper - III	2	I / E	50 / 50
VI	GLY3601	Economic Geology	Theory Paper - 1	3	I / E	50 / 50
	GLY3602	Igneous, Sedimentary and Metamorphic Petrology	Theory Paper - 2	3	I / E	50 / 50
	GLY3603	Phanerozoic Stratigraphy of India and Palaeontology	Theory Paper - 3	3	I / E	50 / 50
	GLY3604	Hydrogeology	Theory Paper - 4	3	I / E	50 / 50
	GLY3605	Environmental Geology	Theory Paper - 5 (A)	3	I / E	50 / 50
			OR			
	GLY3606	Soil Geology	Theory Paper - 5 (B)	3	I / E	50 / 50
	GLY3607	Introduction to Oceanic & Atmospheric Sciences	Theory Paper - 6 (A)	3	I / E	50 / 50
			OR			
	GLY3608	Fossil fuels, Mining methods & National Mineral Policy	Theory Paper - 6 (B)	3	I / E	50 / 50
	GLY3611	Geology Practical - IV	Practical Paper - IV	2	I / E	50 / 50
	GLY3612	Geology Practical - V	Practical Paper - V	2	I / E	50 / 50
	GLY3613	Geology Practical - VI	Practical Paper - VI	2	I / E	50 / 50

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - I
TITLE: MINERALOGY, OPTICS AND CRYSTALLOGRAPHY
PAPER CODE: GLY3501

[CREDITS - 3]

Learning Objectives:

1. To understand the basics of crystallography.
2. To learn the optical and physical properties of various rock forming minerals and to identify them.
3. To learn to identify the common rock forming minerals under microscope and in hand specimen.

	Title and Contents	No. of Lectures
Unit-I	<p>Crystallography and Introduction to Optics</p> <p>A) Crystallography</p> <ul style="list-style-type: none"> ➤ Definition of a crystal. External and internal imperfections in crystals, Growth of crystals in cavities ➤ Study of Holohedral, Hemihedral and Hemimorphic forms of crystals with suitable examples ➤ Study of Cubic system (Type Pyrite & Type Tetrahedrite) ➤ Study of Hexagonal system (Type Calcite, Type Quartz & Type Tourmaline) ➤ Determination of axial ratio ➤ Twinning: Definition, causes, parts of twins, types of twins, laws of twinning ➤ Phenomenon of Isomorphism, Polymorphism & Pseudomorphism ➤ Introduction to Stereographic Projections of Elements of Symmetry <p>B) Introduction to Optics</p> <ul style="list-style-type: none"> ➤ Types of Twinning and Zoning in minerals under the petrographic microscope ➤ Refractive index and its comparison with Becke line, shadow method and immersion method ➤ Relief of minerals 	15
Unit-II	<p>Optics and Study of Non-silicate minerals</p> <p>A) Optics</p> <ul style="list-style-type: none"> ➤ Isotropism and Anisotropism ➤ Extinction ➤ Interference colours, Relative retardation and Newton's scale of Interference colours ➤ Uniaxial and biaxial indicatrices ➤ Pleochroism and absorption ➤ Accessory plates: Mica plate, Gypsum plate and quartz wedge ➤ Sign of elongation in minerals <p>B) Study of the following non-silicate minerals</p>	15

	<p style="text-align: center;">with respect to their chemical composition, properties and uses</p> <ul style="list-style-type: none"> ➤ Precious and Semiprecious stones ➤ Oxides: Corundum, Hematite, Ilmenite, Rutile & Limonite ➤ Sulphides: Pyrite, Sphalerite, Galena ➤ Sulphates: Gypsum and Baryte ➤ Carbonates: Calcite, Aragonite, Rhodochrosite & Siderite ➤ Phosphates: Apatite, Monazite ➤ Halides: Fluorite & Halite 	
Unit-III	<p>Study of silicate mineral groups</p> <p>Study of following silicate mineral groups with reference to their silicate structure, chemical composition, physical & optical properties, paragenesis and alteration products:</p> <ul style="list-style-type: none"> ➤ Olivine group ➤ Pyroxene group ➤ Amphibole group ➤ Mica group ➤ Chlorite group ➤ Feldspar group ➤ Zeolite group ➤ Garnet group ➤ Aluminosilicate group ➤ Felspathoid group ➤ Clay mineral group 	15

References:

1. Rutley's Elements of Mineralogy by H. H. Read.
2. Mineralogy by Berry & Mason
3. Mineralogy by Dexter Perkins
4. An Introduction to the rock forming minerals by Deer, Howie, Zussman
5. Manual of Mineralogy by Kleine & Hurlbut C. S.
6. Optical Mineralogy by Kerr P. F.
7. Optical Mineralogy by Whalstrom E. E.
8. Optical Mineralogy & Non opaque minerals by Philip W.R. & Griffen D. T.
9. Dana's textbook of Mineralogy by William E. Ford.
10. Optical Mineralogy by S. Ray and PRJ Naidu

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - II
TITLE: STRUCTURAL GEOLOGY AND TECTONICS
PAPER CODE: GLY3502

[CREDITS - 3]

Learning Objectives:

1. To understand the formation of various structures.
2. To identify various structures.
3. To learn about the processes involved in dynamics of the Earth.

	Title and Contents	No. of Lectures
Unit-I	<p>Rock Deformation</p> <ul style="list-style-type: none"> ➤ Components of deformation - Force, Confining / Hydrostatic pressure & differential forces ➤ Stress & Strain, Rupture strength, Ultimate strength & Fundamental strength. ➤ Factors controlling rock deformation: Confining pressure, temperature, time, solution ➤ Anisotropy and inhomogeneity of rocks. ➤ Definition of plastic, ductile and brittle deformation ➤ Structural levels, brittle, ductile, brittle-ductile transition, natural examples. ➤ Mechanisms of plastic deformation ➤ Fracture and brittle deformation ➤ Stress & Strain ellipsoid ➤ Faults ➤ Folds and Folding ➤ Analysis of deformation history from deformed rocks 	15
Unit-II	<p>Deformation Structures and interior of the earth</p> <p>A) Deformation Structures</p> <ul style="list-style-type: none"> ➤ Foliation and cleavage ➤ Lineation and Linear structures. ➤ Shear zones and Mylonites ➤ Descriptive Analysis of structures, Mohr Strain Analysis, fault, joint and fold analysis, geometric analysis of folds. ➤ Stereographic projections. <p>B) Interior of the earth</p> <ul style="list-style-type: none"> ➤ Physical-chemical characteristics of the different layers of the Interior of the earth ➤ Composition, physical properties & characteristics of three spherical zones of the Earth - crust, mantle (including LVZ) & core ➤ Concept of Lithosphere, Asthenosphere & Mesosphere ➤ Earth's Magnetic field & Geodynamo ➤ Concept of Polar wandering & its application in plate tectonics ➤ Magnetic anomalies & sea floor Spreading 	15

Unit-III	Tectonics <ul style="list-style-type: none"> ➤ Extensional regimes, Strike-slip, transpression and transtension. ➤ Historical background of the plate tectonics theory ➤ Introduction to Wilson's cycle & Concept of plate tectonics. ➤ Characteristics of lithospheric plates, Concept of plate margin & plate boundary. ➤ Three plate boundaries - (Divergent, Convergent & Transform fault -description & examples) ➤ Present motion of world's large plates. ➤ Concept of triple junctions with their examples. ➤ Concept of hot plumes & hot spots with examples. ➤ Spatial and Temporal evolution of palaeo - supercontinents to present continents. 	15
References: <ol style="list-style-type: none"> 1. M. P. Billings (1984), Structural Geology, 3rd ed., Printice Hall, 514 pp. 2. Haakon Fossen (2010), Cambridge University press, 481 pp. 3. George H. Davis, Stephen J. Reynolds, and Chuck Kluth (2012), Structural Geology of Rocks and Regions, John Wiley and Sons, 3rd ed., 861 pp. 4. V. Radhakrishnan (1987), General Geology, V. V. P. Publishers, Tuticorin 321 pp. 5. Condie (1997), Plate Tectonics and Crustal Evolution 4th ed., Butterworth Heinemann, Oxford 282 pp. 6. Keary, P. and Vine, F (1996), Global Tectonics, Blackwell Science, 495 pp. 		

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - III
TITLE: PRECAMBRIAN STRATIGRAPHY OF INDIA
PAPER CODE: GLY3503

[CREDITS - 3]

Learning Objectives:

1. To understand the World and Indian Precambrian history in terms of cratons and mobile belts.
2. To review various Indian stratigraphic units against the Geological Time scale.
3. To learn about various Precambrian stratigraphic units and mobile belts of India in details.

	Title and Contents	No. of Lectures
Unit-I	<p>Introduction to Indian and World Precambrian History and Precambrians of Extra Peninsular India</p> <ul style="list-style-type: none"> ➤ Physiographic / Tectonic divisions of India and their comparisons ➤ Definition of Tectonic Elements of continents (cratons, shield, folded mountain belts) and oceans (mid-oceanic ridges, trenches and transform faults) ➤ Cratons of India and associated Proterozoic basins ➤ General review of Indian Stratigraphy & Classification of the Indian litho-stratigraphic units, according to the Geological time scale. ➤ Earlier and current classification of Precambrian formations of India by - Sir T.H. Holland, Sarkar et al (1976), and Ramkrishna and Vaidyanathan (ICS, 2014) ➤ World Precambrian history in brief ➤ Cratons and mobile belts of the World ➤ Precambrians of the Extra-Peninsula 	15
Unit-II	<p>Precambrian rocks of Peninsular India</p> <p>Brief account of their distribution, Geographical location, classification, lithological succession, structure and economic importance, with a broad stratigraphic correlation.</p> <ul style="list-style-type: none"> ➤ Dharwar Craton ➤ Singbhum - Odisha Iron Ore Craton ➤ Central Indian Craton / Bastar Craton ➤ Aravalli Craton ➤ Bundelkhand Craton 	15
Unit-III	<p>Precambrian mobile belts and Craton wise Precambrian sedimentary basins of India</p> <p>A) Precambrian mobile belts of India</p> <ul style="list-style-type: none"> ➤ Eastern Ghat mobile belt ➤ Satpura mobile belt/ CITZ (Central Indian Tectonic Zone) ➤ Pandyan Mobile Belt <p>B) Stratigraphy and Economic Importance of:</p> <ul style="list-style-type: none"> ➤ Aravalli Supergroup ➤ Delhi Supergroup ➤ Cuddapah Supergroup ➤ Kaladgi Supergroup ➤ Vindhyan Supergroup 	15

	➤ Chhattisgarh Supergroup	
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References:

1. Stratigraphy of India and Burma - By M. S. Krishnan
2. Fundamentals of Historical Geology and Stratigraphy of India - By Ravindra Kumar
3. Geology of India Vol. 1 & 2. Ramkrishna - Vaidyanathan - Geological Society of India, Special Publication.

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - IV
TITLE: GEOMORPHOLOGY, REMOTE SENSING & FIELD GEOLOGY
PAPER CODE: GLY3504

[CREDITS - 3]

Learning Objectives:

1. To learn field techniques in Geology.
2. To introduce the basic geomorphic landforms.
3. To understand the processes and applications in remote sensing.

	Title and Contents	No. of Lectures
Unit-I	<p>Field Geology and Geomorphology</p> <p>A) Field Geology</p> <ul style="list-style-type: none"> ➤ Aims, objectives and preparation for fieldwork ➤ Study of Outcrop ➤ Geological Mapping <p>B) Geomorphology</p> <ul style="list-style-type: none"> ➤ Introduction to Geomorphic Concepts ➤ Landforms: Role of Lithology, Endogenous and Exogenous Processes, Climatic And Tectonic Forces ➤ Study of Different Landforms ➤ Introduction to GAT indices 	15
Unit-II	<p>Principles of Remote Sensing and Photogeology</p> <p>A) Principles of Remote Sensing</p> <ul style="list-style-type: none"> ➤ Definition, History, Types of Remote sensing Systems ➤ Energy source and radiation principles ➤ Energy interactions in the atmosphere, with the earth, Spectral reflectance of vegetation, soil & water; Data acquisition & interpretation. ➤ Use of drones for remote sensing <p>B) Photogeology</p> <ul style="list-style-type: none"> ➤ Classification of aerial photographs ➤ Planning of Aerial photography, Acquiring stereographic photography, Discrepancies in aerial photographs ➤ Geometric characteristics of Aerial photos, marginal information on Aerial photos, Scale of Aerial photos, ground and photographic resolution of Aerial photos, Vertical exaggeration and relief displacement in Aerial photos. ➤ Stereoscopy ➤ Photo recognition Elements ➤ Advantages and limitations of Aerial photos. ➤ Photo-geological interpretations 	15

Unit-III	Satellites, Satellite data and Applications of Remote Sensing <ul style="list-style-type: none"> ➤ Introduction to Satellites, Sensors & their applications ➤ Brief history, Types of Satellites (Orbital Characteristics, Sensors and applications with reference to latest IRS & LANDSAT: LANDSAT 7 and 8, IRS satellites - Oceansat, Cartosat, Resourcesat, SARAL) ➤ Scanners - Hyperspectral Scanners, Active Remote Sensing Systems - RADAR and LIDAR (Principles & applications) ➤ Image characteristics & Spectral responses of various features ➤ Applications of Remote sensing in studying the natural resources & in geo-technical investigations 	15
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References:

1. Manual of Field Geology: Compton R. J.
2. Field Geology: Lahee
3. Geomorphology: Varad Rajan
4. Geomorphology: Thornburry
5. Concepts of Geomorphology: Gupta and Kale
6. Remote Sensing and Image Interpretation: Kiefer and Lillesand
7. Principles and Applications of Photogeology: Pandey S. N.
8. Photogeology: Gupta

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - V
TITLE: ENGINEERING GEOLOGY
PAPER CODE: GLY3505

[CREDITS - 3]

Learning Objectives:

1. To understand the importance of geology in civil engineering projects.
2. To understand the engineering properties of rocks.
3. To learn about the different geological materials used in engineering projects.
4. To understand the methodology for selection of civil engineering project sites.

	Title and Contents	No. of Lectures
Unit-I	<p>Engineering behaviour of rock</p> <p>A)Introduction:</p> <ul style="list-style-type: none"> ➤ Introduction to Engineering Geology ➤ Applications of geology in Civil engineering projects <p>B) Engineering properties of rocks:</p> <ul style="list-style-type: none"> ➤ Foundation Material ➤ Building Stone ➤ Factors controlling the engineering properties of the rock. ➤ Importance of weathering and clay formations. <p>C) Rocks as Construction Material:</p> <ul style="list-style-type: none"> ➤ Building stone, Facing stone, and Foundation material. ➤ Factors influencing engineering usefulness of the rocks (Durability of rock). 	15
Unit-II	<p>Aggregates and rock characterisation</p> <p>A) Physical and Engineering properties of aggregates:</p> <ul style="list-style-type: none"> ➤ Physical properties of aggregates ➤ Engineering Properties of aggregate <p>B) Types, Uses and Sources of aggregates:</p> <ul style="list-style-type: none"> ➤ Use of rocks as an aggregate in different types of constructions, source of different grades of aggregates ➤ Types of aggregates <p>C) Engineering classification of rock</p> <ul style="list-style-type: none"> ➤ Rock mass Rating, Quality, Rock mass Index and geological strength index, ➤ Stability of slopes, urbanization and waste disposal. ➤ Ground improvement and preventive measures. 	15

Unit-III	<p>Site investigations</p> <p>A) Study of foundation rocks:</p> <ul style="list-style-type: none"> ➤ With reference to tunnelling, dams, reservoirs and bridges, ➤ Scale factor and insitu measurements, ➤ Quantitative measurements of discontinuities. <p>B) Tunnels:</p> <ul style="list-style-type: none"> ➤ Types of tunnels and Site selection for tunnel construction ➤ Tunnelling in various terrains ➤ Role of groundwater in tunnelling ➤ Names and locations of at least six very important tunnels in India. Case study: Jawahar Tunnel and Failure case study <p>C) Dams and Reservoirs:</p> <ul style="list-style-type: none"> ➤ Types of Dams and reservoirs ➤ Site selection for dam and reservoir construction ➤ Location with type of all the important dams and hydroelectric projects in India. Case study: Sardar Sarovar Dam and Failure case study <p>D) Bridge:</p> <ul style="list-style-type: none"> ➤ Types of bridges and Site selection for bridge construction ➤ Names and locations of at least six very important bridges in India. Case study: Mumbai Sea-Link, Failure case study 	15
<p>References:</p> <ol style="list-style-type: none"> 1. Principles of Engineering Geology: Krynine & Judd 2. Engineering Geology: Parbin Singh 3. Fundamentals of Engineering Geology: R. S. Khurami 4. Lianyang Zhang, 2016, Engineering Properties of Rocks, Elsevier, 386 pp. 5. Bhawani Singh and Goel R. K., 2011, Engineering Rock Mass Classification: A Practical Approach in Civil Engineering, Elsevier, 382 pp. 		

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - V
TITLE: PRINCIPLES OF GEOCHEMISTRY
PAPER CODE: GLY3506

[CREDITS - 3]

Learning Objectives:

1. To understand the various techniques used in geochemical studies of igneous rocks.
2. To know about various techniques used in geochemical studies of sedimentary rocks.
3. To learn about the various techniques used in geochemical studies of metamorphic rocks.

	Title and Contents	No. of Lectures
Unit-I	<p>Concepts in Geochemistry</p> <ul style="list-style-type: none"> ➤ Introduction and History ➤ Nucleosynthesis, Cosmic Abundance of elements ➤ Atomic Structure, Periodic Table - Emphasis on D block and F block elements ➤ Goldschmidt's Classification ➤ Atomic substitution ➤ Primary differentiation and chemical structure of the earth ➤ Geochemical Cycles ➤ Laws of thermodynamics and their uses in Geoscience ➤ Isotopes - Concepts and Introduction to applications in Geosciences 	15
Unit-II	<p>Geochemistry in Igneous Petrology</p> <ul style="list-style-type: none"> ➤ Introduction to the concepts like major oxides, minor oxides and trace elements ➤ Applications of isotope methods in Igneous Petrology - Selection of method and minerals, Representation and interpretation of data ➤ Introduction to the principles of analytical techniques used in Igneous petrology - XRD, XRF, ICPMS, EPMA 	15
Unit-III	<p>Geochemistry in Sedimentary and Metamorphic Petrology</p> <ul style="list-style-type: none"> ➤ Physicochemical factors in Sedimentation - Ionic Potential, H ion concentration, Oxidation - Reduction Potential, Residence time ➤ Chemical Tests in Sedimentary rocks ➤ Applications of isotope methods in Sedimentary Petrology - Selection of methods and minerals, Representation and interpretation of data ➤ Biogeochemistry - Origin and chemistry of Hydrocarbons ➤ Geochemistry of Stability of minerals ➤ Geochemistry of Metasomatism ➤ Metamorphic reactions - concepts, ACF, AKF and AFM diagrams 	15

	➤ Applications of analytical techniques such as EPMA in Metamorphic Petrology	
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References:

1. Principles of Geochemistry by Mason B. and Moore C.
2. Principles of Stable Isotope Geochemistry by Zachary Sharp
3. Principles of Geochemistry by Giulio Ottonello

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - VI
TITLE: QUATERNARY GEOLOGY AND PALAEOCLIMATE
PAPER CODE: GLY3507

[CREDITS - 3]

Learning Objectives:

1. To understand Quaternary as a geological time period.
2. To learn about radiometric dating.
3. To understand the different climatic changes during Quaternary period.
4. To learn the basic evolutionary changes in organisms of Quaternary period.

	Title and Contents	No. of Lectures
Unit-I	<p>Introduction to Quaternary Geology</p> <p>A) Overview of Quaternary Geology:</p> <ul style="list-style-type: none"> ➤ Introduction to Quaternary Geology, Concepts <p>B) Quaternary Stratigraphy:</p> <ul style="list-style-type: none"> ➤ Oxygen Isotope stratigraphy ➤ Biostratigraphy ➤ Magneto-stratigraphy. <p>C) Quaternary dating methods:</p> <ul style="list-style-type: none"> ➤ Radiocarbon, ➤ Uranium series, ➤ Luminescence and Amino acid. 	15
Unit-II	<p>Climates in Quaternary Period</p> <p>A) Quaternary climates</p> <ul style="list-style-type: none"> ➤ Glacial-interglacial cycles, ➤ Eustatic changes, ➤ Proxy indicators of palaeo-environmental / palaeo-climatic changes, - land, ocean and cryosphere (ice core studies). <p>B) Geomorphic System and climates</p> <ul style="list-style-type: none"> ➤ Responses of geomorphic systems to climate, sea level ➤ Tectonics on variable time scales in the Quaternary Period. 	15
Unit-III	<p>Quaternary Sequences</p> <p>A) Quaternary Stratigraphy of India</p> <ul style="list-style-type: none"> ➤ Continental records ➤ Marine records ➤ Continental-marine correlation of Quaternary record. <p>B) Evolution in Quaternary Period</p> <ul style="list-style-type: none"> ➤ Evolution of man and Stone Age cultures. ➤ Plant and animal life in relation to glacial and interglacial cycles during Quaternary. 	15

References:

1. Geological Society of India: Quaternary of India
2. Lowe, J. J. & Walker, M. J. C., 1997: Reconstructing Quaternary Environments Longman, ISBN 0-582-100166-2, pp. 1-16, 148-373.
3. Bradley, 1999, Paleoclimatology.

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PAPER - VI
TITLE: BASICS OF GEOPHYSICS AND GEOPHYSICAL PROSPECTING
PAPER CODE: GLY3508

[CREDITS - 3]

Learning Objectives:

1. To study the principles involved in gravitational prospecting.
2. To study the principles involved in magnetic prospecting.
3. To understand the principles involved in electrical prospecting.
4. To learn about the principles involved in seismic prospecting.

	Title and Contents	No. of Lectures
Unit-I	<p>Gravity and the Earth</p> <ul style="list-style-type: none"> ➤ Law of Universal Gravitation - concept, gravitational acceleration, Gravitational potential, mass and density distribution in the earth ➤ Gravitational prospecting - Measurement of gravity - instruments and their principles, Corrections of gravity measurements, Representation and interpretations of gravity measurements 	15
Unit-II	<p>Magnetic and Electric Properties of the Earth</p> <ul style="list-style-type: none"> ➤ Physics of magnetism ➤ Geomagnetism & Rock magnetism ➤ Palaeomagnetism - Concept and applications ➤ Magnetic Prospecting - Measurement of magnetism - instruments and their principles, Representation and interpretation of magnetic data ➤ Electrical Principles ➤ Electrical Properties of earth - Electric conductivity in the earth ➤ Electrical prospecting - Introduction to Natural potential and currents, Self potential, telluric currents, resistivity, VES, Induced polarization 	15
Unit-III	<p>Seismology</p> <ul style="list-style-type: none"> ➤ Seismic waves- Types, characters ➤ Seismic wave propagation - Huygen's principle, Fermat's principle, critical reflection ➤ Seismic Prospecting- Reflection seismology- reflection at horizontal surface, reflection at inclined surface, concept of seismic noise 	15

References:

1. Fundamentals of Geophysics, Cambridge University Press by William Lowrie
2. Physics and Geology by J. Tuzo Wilson
3. Introduction to Geophysical Prospecting by Dobrain

**T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - I**

**PRACTICALS RELATED TO:
GLY3501 - Mineralogy and Optics
AND
GLY3507 - Quaternary Geology and Palaeoclimate
OR
GLY3508 - Basics Of Geophysics and Geophysical Prospecting**

PAPER CODE: GLY3509

(CREDITS - 2)

Practicals related to GLY3501 Mineralogy and Optics

Sr. No.	Title	No. of Practicals required
1	Study of megascopic minerals (D)	1
2	Study of microscopic minerals (D)	1
3	Crystallography - Study of Cubic System Type- Pyrite and Tetrahedrite (D)	1
4	Crystallography - Study of Hexagonal System Type Calcite, Quartz and Tourmaline (D)	1
5	A) Optics- R.I. and Sign of elongation (E) B) Study of Twin Crystals and Axial Ratios (D+E)	1

Practicals related to GLY3507 Quaternary Geology and Palaeoclimate

Sr. No.	Title	No. of Practicals required
1	Reading the Quaternary Geological time scale.(E)	1
2	Orbital parameters and climate change: (E) A) Tilt of the earth rotational axis and seasonality. Exercise how the tilt 22½ to 24½ can change the seasonality in northern hemisphere. B) How Precession and Eccentricity will change the climate in northern hemisphere.	1
3	A) Quaternary sea level changes: From coastal terraces, how we can calculate the sea level change. The factors of upliftment and subsidence to influence the sea level change. (E) B) Depositional systems and their sensitivity to climate. (E)	1
4	Understanding the Milankovic cycles and some proxy record (case study). (E)	1
5	Oxygen Isotope Records of glacial-interglacial cycles (case study). (E)	1

Practicals related to GLY3508 Basics of Geophysics and Geophysical Prospecting

Sr. No.	Title	No. of Practicals required
1	Numerical problems related to gravity data (E)	1
2	Numerical problems related to magnetic data (E)	1
3	Numerical problems related to palaeo-magnetism (E)	1
4	Resistivity survey and data analysis (E)	1
5	Numerical problems related to seismic data (E)	1

T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - II

PRACTICALS RELATED TO:
GLY3502 - Structural Geology
AND
GLY3503 - Precambrian Stratigraphy of India

PAPER CODE: GLY3510

[CREDITS - 2]

Practicals related to GLY3502 - Structural Geology

Sr. No.	Title	No. of Practicals required
1	Geological maps (E)	5
2	Structural Problems (Graphical and Stereographic) (E)	3
3	A) Completion of outcrops (E) B) Stereographic projections of the different types of folds (E)	1

Practicals related to GLY3503 - Precambrian Stratigraphy of India

Sr. No.	Title	No. of Practicals required
1	Preparation of maps showing geographical distribution of the various Precambrian stratigraphic units of India (E)	1

**T.Y. B.Sc. (GEOLOGY) SEMESTER - V
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - III**

**PRACTICALS RELATED TO:
GLY3504 - Field Geology, Geomorphology &
Remote Sensing
AND
GLY3505 - Engineering Geology
OR
GLY3506 - Principles of Geochemistry**

PAPER CODE: GLY3511

[CREDITS - 2]

Practicals related to GLY3504 - Field Geology, Geomorphology and Remote Sensing

Sr. No.	Title	No. of Practicals required
1	Morphometry - Drainage basin analysis (E)	1
2	Problems related to scale of aerial photographs and relief displacement (Type A to E) (E)	1
3	Geomorphic, lithological and structural interpretations from aerial photographs (E)	1
4	Interpretation of Satellite Images (E)	1
5	A) Lineament analysis (E) B) Standard symbols and colour codes in geological maps (D)	1

Practicals related to GLY3505 - Engineering Geology

Sr. No.	Title	No. of Practicals required
1	Preparation of section along mentioned directions and interpretation for construction of dam, tunnel and bridge. (E)	2
2	Preparation of subsurface map from given bore well data and interpretation for construction of dam and tunnel. (E)	2
3	Study of physical and engineering properties of aggregates and building stone (D)	1

Practicals related to GLY3506 - Principles of Geochemistry

Sr. No.	Title	No. of Practicals required
1	Numerical problem related to Isotopes (E)	1
2	Numerical problems related to Nucleosynthesis (E)	1
3	Plotting and interpretation of variation plots (E)	1
4	Analysis of XRD data (E)	1
5	Plotting and interpretation of ACF, AKF and AFM Diagrams (E)	1

Deccan Education Society's
FERGUSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY
THIRD YEAR B.Sc. (GEOLOGY)
SEMESTER - VI

SYLLABUS FOR T. Y. B. Sc.
Academic Year 2018-2019

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - I
TITLE: ECONOMIC GEOLOGY
PAPER CODE: GLY3601

[CREDITS - 3]

Learning Objectives:

1. To learn the different processes of formation of mineral deposits.
2. To understand about different metallic and non-metallic mineral deposits of India with respect to their geological and geographic occurrences.
3. To learn about coal and petroleum occurrences in India.

	Title and Contents	No. of Lectures
Unit-I	<p>Basics of Economic geology & Primary processes of formation of mineral deposits</p> <ul style="list-style-type: none"> ➤ Introduction: Ore, gangue, tenor, overburden, country rock, syngenetic and epigenetic deposits ➤ Classification of metalliferous and non-metalliferous deposits ➤ Processes of formation of mineral deposits <ul style="list-style-type: none"> • Magmatic concentration • Hydrothermal process • Cavity filling deposits • Metasomatic replacement 	15
Unit-II	<p>Secondary processes of formation of mineral deposits, Radioactive minerals, Polymetallic nodules and Geothermal Energy</p> <p>A) Secondary processes of formation of mineral deposits</p> <ul style="list-style-type: none"> ➤ Oxidation and supergene enrichment ➤ Evaporation ➤ Residual concentration ➤ Mechanical concentration <p>B) Radioactive minerals, Polymetallic nodules and Geothermal Energy</p> <ul style="list-style-type: none"> ➤ Mode of occurrence, mineralogy, properties, uses, geological and geographical distribution of radioactive minerals: Uranium & Thorium ➤ Introduction to Polymetallic nodules ➤ Introduction to Geothermal Energy 	15
Unit-III	<p>Study of metallic and non-metallic deposits</p> <p>A) Study of following metallic deposits with reference to their mode of occurrence, mineralogy, properties, uses, geological and geographical distribution:</p> <ul style="list-style-type: none"> ➤ Precious metals: Gold, Silver ➤ Non-ferrous metals: Copper, Lead, Zinc and Aluminium ➤ Iron and Ferro alloy metals: Iron, Manganese, Nickel & Chromium <p>B) Study of following non-metallic mineral deposits with reference to mode of occurrence, properties and uses:</p> <ul style="list-style-type: none"> ➤ Industrial and manufacturing materials: Asbestos, Mica, talc, Baryte, Glass sand, bleaching clay & Optical crystals 	15

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| | <ul style="list-style-type: none">➤ Chemical minerals: Salt & brines, Borax, Na compounds, Ca & Mg chloride➤ Fertilizer minerals: Potash, Nitrate & Phosphate➤ Abrasives & Abrasive minerals: Diamond, Corundum, Emery & Garnet➤ Refractory minerals: Fire clay, Kyanite, Chromite, Graphite, Magnesite and Dolomite | |
|--|---|--|

References:

1. Economic mineral deposits by Bateman
2. Ore deposits of India by Gokhale & Rao
3. India's Mineral Resources by Krishnaswami
4. India's Minerals by D. N. Wadia
5. Industrial Minerals by Deb.
6. Geology of the industrial rocks & minerals by Robert L. Bates
7. Economic Geology by Umeshwar Prasad
8. Economic mineral deposits of India by Umate (IBM)
9. Economic Ore Deposits by Park & McDermitt (1997)

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - II
TITLE: IGNEOUS, SEDIMENTARY AND METAMORPHIC PETROLOGY
PAPER CODE: GLY3602

[CREDITS - 3]

Learning Objectives:

1. To understand the various processes involved in formation of igneous rocks.
2. To understand the various processes involved in formation of sedimentary rocks.
3. To learn about the various processes involved in formation of metamorphic rocks.

	Title and Contents	No. of Lectures
Unit-I	Igneous Petrology <ul style="list-style-type: none"> ➤ Processes of Magmatic Differentiation ➤ Role of volatile constituents in differentiation of magma ➤ Classification of igneous rocks - Complexity in classification, Shand's classification, CIPW classification, IUGS (plutonic, volcanic) classifications ➤ Petrographic Provinces, Rock Kindreds and Description of Igneous Rocks 	15
Unit-II	Sedimentary Petrology <ul style="list-style-type: none"> ➤ Texture & Structures of Sedimentary Rocks ➤ Introduction to sedimentary facies: Definition, nomenclature & types of Sedimentary facies, Walther's Law of Facies. 	15
Unit-III	Metamorphic Petrology <ul style="list-style-type: none"> ➤ Salient features and effects of Thermal Metamorphism ➤ Salient features and effects of Dynamic / Cataclastic Metamorphism ➤ Salient features and effects of Regional Metamorphism ➤ Salient features and effects of Pneumatolysis / Metasomatism 	15

References:

1. Igneous, metamorphic and sedimentary Rocks: Elher and Blatt
2. Igneous and metamorphic Petrology: Turner and Verhoogen
3. Principles of Igneous and Metamorphic Petrology: John D. Winter
4. Sedimentary Petrology by Pettijohn
5. Introduction to Sedimentology by Sengupta

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - III
TITLE: PHANEROZOIC STRATIGRAPHY OF INDIA AND PALAEOONTOLOGY
PAPER CODE: GLY3603

[CREDITS - 3]

Learning Objectives:

1. To learn regarding the Global Type Sections for various Systems of Phanerozoic Eon and understand phenomenon of mass extinctions.
2. To understand various Phanerozoic stratigraphic units of India.
3. To understand Geology and Stratigraphy of Maharashtra.

	Title and Contents	No. of Lectures
Unit-I	<p>Introduction to Phanerozoic Stratigraphy and Palaeontology</p> <ul style="list-style-type: none"> ➤ Precambrian-Cambrian boundary, Permo-Triassic Boundary, Cretaceous-Palaeogene Boundary, Palaeogene-Neogene Boundary ➤ Study of following Geological systems with reference to their global type area, broad lithology, fossils content: Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous & Tertiary ➤ Palaeontology <ol style="list-style-type: none"> a) Morphology, Classification & distribution of Graptolites. b) Mass extinctions c) Palaeo-botany 	15
Unit-II	<p>Phanerozoic Stratigraphy of Peninsular India</p> <p>A) Palaeozoic Formations of Peninsular India</p> <ul style="list-style-type: none"> ➤ A brief history of the Paleozoic Formations ➤ Gondwana Supergroup <p>B) Mesozoic Formations of Peninsular India</p> <ul style="list-style-type: none"> ➤ A brief history of the Mesozoic formations. ➤ Jurassic of Kachchh and Rajasthan ➤ Cretaceous of Narmada Valley/Bagh beds. ➤ Cretaceous of Cauvery basin. ➤ Lameta Beds <p>C) Cenozoic Formations of Peninsular India</p> <ul style="list-style-type: none"> ➤ Tertiary of Assam ➤ Tertiary of the K-G basin ➤ Tertiary formations along the West Coast. ➤ Laterites: Definition, Origin, Types and distribution. 	15
Unit-III	<p>Phanerozoic Stratigraphy of Extra-Peninsular India, Geology of Maharashtra and Deccan Volcanic Province</p> <p>A) The Phanerozoic Stratigraphy of Extra-Peninsular India</p> <ul style="list-style-type: none"> ➤ Classification, lithological succession and fossil content of the: <ol style="list-style-type: none"> a) Lahaul-Spiti area b) Siwaliks 	15

	B) Geology and Stratigraphy of Maharashtra ➤ Special reference to The Deccan Volcanic Province	
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References:

1. Stratigraphy of India and Burma by M. S. Krishnan
2. Fundamentals of Historical Geology and Stratigraphy of India by Ravindra Kumar
3. Geology of India Vol. 1 & 2, Ramkrishna - Vaidyanathan - Geological Society of India, Special Publication
4. Historical Geology of India by S. K. Shah
5. Geology of Rajasthan (Northwest India) Precambrian to Recent by A. B. Roy and S. R. Jakhar
6. Geological of Maharashtra - Geological Society of India - Special Publication by G. G. Deshpande
7. Palaeobotany - Arnold
8. Invertebrate Palaeontology - Clarkson

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI**GEOLOGY PAPER - IV****TITLE: HYDROGEOLOGY****PAPER CODE: GLY3604****[CREDITS - 3]****Learning Objectives:**

1. To understand the basic principles in hydrogeology.
2. To study aquifers and related aspects.
3. To give a brief introduction to groundwater scenario and problems in India.

	Title and Contents	No. of Lectures
Unit-I	Introduction to Hydrogeology and aquifers <ul style="list-style-type: none">➤ Definition - Hydrology, Hydrogeology➤ Global groundwater scenario, Indian groundwater scenario and scope and groundwater development in India.➤ Groundwater and the hydrologic cycle➤ Groundwater as a resource, Groundwater crises➤ Groundwater and geologic processes➤ Vertical distribution of groundwater➤ Origin of groundwater and rock properties affecting groundwater (porosity, permeability, their types & effects)➤ Aquifers, Geologic formations as aquifers.➤ Types of aquifers (Confined, Unconfined and Perched)➤ Factors controlling groundwater distribution (topography, climate, structural, geological, proximity of tanks, rivers, etc.)➤ Springs (cold & hot) and conditions for formation of springs, types of springs, Base flows and stream flow.	15
Unit-II	Groundwater accumulation, movement and recharge methods <ul style="list-style-type: none">➤ Groundwater accumulation➤ Groundwater movement (Darcy's law)➤ Groundwater balance and budgeting➤ Groundwater recharge methods, Introduction to artificial recharge methods, Types of recharge methods:<ol style="list-style-type: none">a) Water spreading methods (Flooding, Basin, Ditch & furrow, Natural channel, Irrigation).b) Recharge through Pits & Shafts, Recharge through wells.c) Rain water harvesting.d) Groundwater recharge methods in Maharashtra (bore-blast & jacket-well techniques)	15
Unit-III	Groundwater Problems, Field Techniques and Groundwater in India A) Ground Water Problems <ul style="list-style-type: none">➤ Introduction to water quality and groundwater pollution➤ Saline water ingress and remedial measures➤ Groundwater over-exploitation B) Field Techniques <ul style="list-style-type: none">➤ Groundwater level measurement and analysis, use of isotope studies➤ Weather parameters and measurement and analysis➤ Introduction to Pumping tests and slug tests	15

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| | <ul style="list-style-type: none">➤ Introduction to watershed development and management➤ Introduction to groundwater modelling techniques <p>C) Groundwater in India</p> <ul style="list-style-type: none">➤ Groundwater provinces of India (Case studies)<ul style="list-style-type: none">a) Mountain system aquifersb) Volcanic system aquifersc) Soft sediment system aquifersd) Hard sediment system aquiferse) Alluvial aquifersf) Basement system aquifers➤ Groundwater agencies in India (Government agencies and NGOs) and Groundwater assessment in India | |
|--|--|--|

References:

1. Groundwater Hydrology: Todd
2. Groundwater: Freeze and Cherry
3. Applied Hydrogeology: C.W. Fetter, Jr.
4. Field Hydrogeology: Rick Brassington
5. Groundwater: H.M. Raghunathan
6. www.acwadam.org Publications

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - V
TITLE: ENVIRONMENTAL GEOLOGY
PAPER CODE: GLY3605

[CREDITS - 3]

Learning Objectives:

1. To understand the importance of geology in environmental science.
2. To learn the basics of Environmental Impact Assessment
3. To understand the different natural and anthropogenic hazards and disasters and mitigation measures.
4. To study soil, air and water pollution - their causes and mitigation measures.

	Title and Contents	No. of Lectures
Unit-I	<p>Scope of Environmental Geology, Environmental Impact Assessment and Conservation of Natural Resources</p> <p>A) Scope of Environmental Geology</p> <ul style="list-style-type: none"> ➤ Concepts, Objectives, and Scope of Environmental Geology ➤ Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles. <p>B) Environmental Impact Assessment</p> <p>C) Conservation of Natural Resources</p>	15
Unit-II	<p>Natural Hazards and Disasters</p> <ul style="list-style-type: none"> ➤ Natural hazards: Definition, type, natural hazard zones and Impact assessment, Natural hazard zonation maps, Role of Geologists in disaster management plan ➤ Distinction between: hazard and disaster ➤ Earthquakes ➤ Volcanoes ➤ Mass movement ➤ Floods ➤ Coastal hazards ➤ Mining hazards ➤ Subsidence of land ➤ Anthropogenic geological hazards 	15
Unit-III	<p>Land Degradation, Pollution and Solid Waste Management</p> <p>A) Deterioration of land surface</p> <ul style="list-style-type: none"> ➤ Dimensions of Erosion, processes, causes of accelerated erosion, remedial measures ➤ Desertification and degradation of land ➤ Soil conservation, badland topography, alkalinity and salinity of soils <p>B) Pollution</p> <ul style="list-style-type: none"> ➤ Parameters and standards ➤ Water Pollution ➤ Soil Pollution ➤ Air pollution ➤ Case studies 	15

	C) Solid Waste Management	
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➤ Solid waste disposal, its effects with geological perspective

References:

1. Environmental Geology by K. S. Valdiya
2. Environmental Geology by E. A. Keller (Latest Edition)
3. Mining & Environment by Bharat B. Dhar
4. Mineral Economics by Sinha R. K.
5. Geology in Environmental Planning: by A. D. Howard.

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - V
TITLE: SOIL GEOLOGY
PAPER CODE: GLY3606

[CREDITS - 3]

Learning Objectives:

1. To learn about the basics of soil geology.
2. To understand the various processes involved in soil genesis.
3. To know about various applications of soil geology.

	Title and Contents	No. of Lectures
Unit-I	<p>Introduction to Soil Geology</p> <ul style="list-style-type: none"> ➤ Definition ➤ Morphology and physical characteristics of soil ➤ Horizons of Soil ➤ Soil mineralogy, weathering rate and crystal structure, mineralogical composition versus soil age. ➤ Minerals in soil (mica and vermiculite, smectites, kaolinite, allophane and halloysite, oxidic clays). ➤ Sampling Techniques, Classification and mapping of the soils. ➤ Indian Soils 	15
Unit-II	<p>Soil Genesis</p> <ul style="list-style-type: none"> ➤ Parent Materials ➤ Weathering ➤ Pedoturbation ➤ Role of organisms in soil genesis ➤ Models and concepts of soil formation 	15
Unit-III	<p>Applications of soil geology</p> <ul style="list-style-type: none"> ➤ Elements of surface morphometry, the catena concept, two case studies. ➤ Soil development and introduction to Surface Exposure Dating ➤ Applications of soil science in agriculture, civil constructions and environmental issues ➤ Soil hydrology 	15

References:

1. Soils: Genesis and Geomorphology (2005); Randall J. Schaetzl, Sharon Anderson
2. Geopedology: An Integration of Geomorphology and Pedology for Soil and Landscape Studies (2016); Joseph Alfred Zinck, Graciela Metternicht, Gerardo Bocco, Héctor Francisco Del Valle
3. Handbook of Soil Sciences (2011); Pan Ming Huang, Yuncong Li, Malcolm E. Sumner.
4. Soils in Construction (2004), W. L. Schroeder, Stephen Dickenson, Pearson.

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - VI
TITLE: INTRODUCTION TO OCEANIC AND ATMOSPHERIC SCIENCES
PAPER CODE: GLY3607

[CREDITS - 3]

Learning Objectives:

1. To learn the characteristics of oceans.
2. To learn about the characteristics of atmosphere.
3. To understand the interaction between ocean and atmosphere.

	Title and Contents	No. of Lectures
Unit -I	<p>Introduction to Oceanography</p> <ul style="list-style-type: none"> ➤ Characteristics of oceans ➤ Physical properties of seawater ➤ Salinity and density ➤ Introduction to tides and ocean currents ➤ Introduction to the oceanic crust and oceanic crustal rocks ➤ Introduction to the oceanic crustal rocks 	15
Unit -II	<p>Atmospheric Science</p> <ul style="list-style-type: none"> ➤ Physical properties of atmosphere ➤ Atmospheric composition ➤ Atmospheric circulation and heat budget of Earth 	15
Unit-III	<p>Coupled Ocean-Atmosphere Systems</p> <ul style="list-style-type: none"> ➤ El-Niño Southern oscillations (ENSO) ➤ General weather system of Indian subcontinent <ul style="list-style-type: none"> • Monsoon • Jet stream • Cyclones • Western disturbances • Severe local convective systems • Distribution of precipitation over India 	15

References:

1. R Gupta's Popular Master Guide: CSIR-UGC NET / JRF Earth, Atmospheric, Ocean and Planetary Sciences by Surendra Kumar, Ed. 2015, Ramesh Publishing House, New Delhi.
2. Atmospheric Sciences: An Introductory Survey by J. M. Wallace and P.V. Hobbs, Academic Press
3. Physical Oceanography: Vol. I & II by A. Defant

T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PAPER - VI
TITLE: FOSSIL FUELS, MINING METHODS AND
NATIONAL MINERAL POLICY
PAPER CODE: GLY3608

[CREDITS - 3]

Learning Objectives:

1. To understand the formation and characteristics of coal.
2. To understand the formation and characteristics of hydrocarbons.
3. To learn about various mining methods.
4. To understand National Mineral Policy, NELP and HELP.

	Title and Contents	No. of Lectures
Unit-I	<p>Coal</p> <ul style="list-style-type: none"> ➤ Coal and its properties. ➤ Different varieties and ranks of coal. ➤ Origin of coal - Coalification process and its causes. ➤ Lithotypes, microlithotypes and macerals: their physical, chemical and optical properties. ➤ Maceral analysis of coal: Mineral and organic matter in coal. ➤ Petrographical methods and tools of examination. ➤ Fundamentals of coal petrology ➤ Concept of coal maturity, peat, lignite, bituminous and anthracite coal. Indian coal & lignite deposits. ➤ Uses of coal for various industries 	15
Unit-II	<p>Hydrocarbons</p> <ul style="list-style-type: none"> ➤ Kerogen and its types ➤ Characters of source and reservoir rocks ➤ Structural, stratigraphic and mixed traps ➤ Origin, migration and entrapment of natural hydrocarbons ➤ Techniques of exploration - different types of well logs. ➤ Geographical and geological distributions of onshore and offshore petroliferous basins of India ➤ Conventional and unconventional resources of hydrocarbons. 	15
Unit-III	<p>Methods of mining, National Mineral Policy and HELP (Hydrocarbon Exploration and Licensing Policy) and NELP (New Exploration and Licensing Policy)</p> <ul style="list-style-type: none"> ➤ Mining methods and terminology associated with mining activities ➤ Case study, Mineral concession rules, Types of licenses, Leasing Process, Mining Plan, Execution of Lease Lead ➤ Mineral conservation and development rules ➤ Background, Objective, Salient features of the National Mineral Policy, HELP and NELP 	15

	<ul style="list-style-type: none">➤ Reclamation / restoration techniques and strategy for mined out areas.➤ Role of Geologists as per MCDR rules.➤ Industrial evaluation of coal characteristics with reference to coal classification.	
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References:

1. Economic Geology: Economic Mineral Deposits Second Edition, Umeshwar Prasad, 2002
2. Mining Geology - II, K. Chandana, 2016
3. Coal Geology, Larry Thomas, 2002.
4. Geology of Petroleum, Second Edition, Levenson A. I., 2006.
5. Mines.nic.in, National Mineral Policy and Legislation related to mining.

**T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - IV**

**PRACTICALS RELATED TO:
GLY3601 - Economic Geology
AND
GLY3607 - Introduction to Oceanic and
Atmospheric Sciences
OR
GLY3608 - Fossil Fuels, Mining Methods and
National Mineral Policy**

PAPER CODE: GLY3611

[CREDITS - 2]

Practicals related to GLY3601 Economic Geology

Sr. No.	Title	No. of Practicals required
1	Megascopic Ore minerals- To study at least 10 selected ore minerals (D)	1
2	Industrial minerals- To study at least 10 selected industrial minerals. (D)	1
3	Preparation of an ore mineral map of India for the following: Fe, Mn, Cr, Cu, Pb, Zn & Al. (E)	1
4	Mineralogical and textural study of common ores under microscope. (D)	1
5	Practicals related to Environmental Impact. (E)	1

Practicals related to GLY3607 Introduction to Oceanic and Atmospheric Sciences

Sr. No.	Title	No. of Practicals required
1	Analysis of surface meteorological data. (E)	1
2	Preparation of isotherms, isobars. (E)	1
3	A) Analysis of rainfall data (E) B) Analysis of surface and upper air weather charts: Monsoon, Western Disturbance, Tropical Cyclone (E)	1
4	Study of the following systems on world map: (E) A) Oceanic conveyor belt with major current systems B) Major atmospheric current systems	1
5	Construction and study of (ocean) bathymetric profile (E)	1

Practicals related to GLY3608 Fossil Fuels, Mining Methods, National Mineral Policy

Sr. No.	Title	No. of Practicals required
1	Preparation of geographical distribution maps of petroliferous basins and coal deposits of India. (E)	1
2	Problems related to mine valuation and calculation by uniform spacing on rectangular coordinate method. (E)	1
3	Study of different types of coals in hand specimen. (D)	1
4	Preparation of geographical distribution maps of existing opencast and underground mines of metallic and non-metallic deposits in India. (E)	1
5	Calculating the tenor and grade of the ore using given data. (E)	1

**T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - V**

**PRACTICALS RELATED TO:
GLY3602 - Igneous, Sedimentary and
Metamorphic Petrology
AND
GLY3603 - Phanerozoic Stratigraphy of India and Palaeontology**

PAPER CODE: GLY3612

[CREDITS - 2]

Practicals related to GLY3602 Igneous, Sedimentary and Metamorphic Petrology

Sr. No.	Title	No. of Practicals required
1	Megascopeic and Microscopic study of various igneous rocks with respect to their texture, structure and mineral composition. (D)	2
2	Problems related to CIPW Norm calculation for silica saturated igneous rocks (E)	1
3	A) Study of various megascopeic and microscopic sedimentary rocks with regard to their texture / structure. (D) B) Interpretation of the sedimentary structures giving their geological significance. (D)	2
4	Analysis of grain size data (E)	1
5	Megascopeic and microscopic study of metamorphic rocks with regards to their texture / structure, mineral composition, colour, type of metamorphism, grade, facies and the original rocks. (D)	2
6	Plotting of Chemical Composition of Metamorphic rocks on ACF diagrams. (E)	1

Practicals related to GLY3603 Phanerozoic Stratigraphy of India and Palaeontology

Sr. No.	Title	No. of Practicals required
1	A) Study of plant fossils associated with Gondwana Sequence of rocks. (D) B) Preparation of maps showing geographical distribution of the various Phanerozoic Stratigraphic units of India (E)	1

**T.Y. B.Sc. (GEOLOGY) SEMESTER - VI
GEOLOGY PRACTICAL PAPER
TITLE: GEOLOGY PRACTICAL - VI**

**PRACTICALS RELATED TO:
GLY3604 - Hydrogeology
AND
GLY3605 - Environmental Geology
OR
GLY3606 - Soil Geology
AND
COMPULSORY 10 DAYS FIELD WORK**

PAPER CODE - GLY3613

(CREDITS - 2)

Practicals Related to GLY3604 Hydrogeology

Sr. No.	Title	No. of Practicals required
1	Preparation of hydrographs using rainfall, water level data and spring discharge data (E)	1
2	Preparation of water table contours to understand flow direction of groundwater and to demarcate recharge and discharge areas (E)	1
3	Pumping test analysis for specific capacity of wells (Slichter's method) (E)	1
4	A) Groundwater quality analysis using Piper's plot (E) B) Analysis of stream flow data for base flow calculations (E) C) Demonstrations and calculations related to porosity and permeability (E)	2

Practicals Related to GLY3605 Environmental Geology

Sr. No.	Title	No. of Practicals required
1	Study of Hazard zonation maps of India and World (D)	1
2	A) Water Quality Index calculations (E) B) Estimation of various solvents in water (E)	1
3	Mine restoration based on mining plan (E)	1
4	Renewable energy related numerical problems (E)	1
5	Estimation of soil erosion using Universal Soil Equation (E)	1

Practicals related to GLY3606 Soil Geology

Sr. No.	Title	No. of Practicals required
1	Study of different types of soils with respect to their texture, colour, consistency, structure and their classification. (D)	1
2	Assessing the weathering intensity of soil using mineral composition. (E)	1
3	Interpretation of different soils along a slope and interpretation of paleoclimate from soil. (E)	1
4	A) Preparation of geographical distribution maps of different types of soils in India. (E) B) Practical related to profile of residual and transported soils. (E)	1
5	Study of thin sections of soil (D)	1