Deccan Education Society's

FERGUSSON COLLEGE (AUTONOMOUS), PUNE

Learning Outcomes-Based Curriculum

for 3/4 years B. Sc. / B. Sc. (Honours) Programme

as per guidelines of

NEP-2020

for

T. Y. B. Sc. (Geology)
(NEP 1.0)

With effect from Academic Year

2025-2026

Deccan Education Society's

Fergusson College (Autonomous), Pune-4

Department of GEOLOGY

Program Outcomes (POs) for B. Sc. Programme	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioural skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Performing dependently and also collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professionalethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSO No.	Program Specific Outcomes (PSOs) Upon completion of this programme the student will be able to
PSO1	**Academic competence:** (i) Describe the knowledge of physical and chemical properties of lithosphere and hydrosphere (minerals, rocks, soils and water etc.). (ii) Demonstrate the knowledge of geologic time and earth's history; dynamics of crustal materials with respect to Plate Tectonics theory, outline of regional geology of India. (iii) Articulate the methods of science and explain why current scientific knowledge is both contestable and testable by further inquiry and to appraise the relationship between different science communities of practice. Pursue further learning in Geology with reasonable knowledge, skills and interest.
PSO2	**Personal and Professional Competence:** (i) Demonstrate the competence in fundamental geological skills like- identification of various minerals and rocks in hand specimens and under the microscope. (ii) Express clearly and convincingly about ideas of science and technology.
PSO3	**Research Competence** (i) Interpret analytically aerial photographs, toposheets and satellite data. (ii) Interpret geological maps and construction of cross section, collection of field data and laboratory data.
PSO4	**Entrepreneurial and Social competence** (i) Evaluate data of the societal relevance of earth systems and the processes. (ii) Apply the knowledge of geology in the fields of Engineering, Mining, Hydrogeology and other areas to solve the problems. (iii) Collaborate in various geological services with demonstration of true values of leadership, co-operation, hard work, teamwork etc. during the field works, surveys and field visits. (iv) Illustrate overall personality traits like stage daring, communication skills, presentation which is essential for future career.

Semester	Paper	Paper Code	Paper Title	Type	Credits	Exam Type
V	Major	GLY-301	MINERALOGY	Theory	2	CE+ESE
		GLY-302	IGNEOUS AND METAMORPHIC PETROLOGY	Theory	2	CE+ESE
		GLY-303	ENGINEERING GEOLOGY	Theory	2	CE+ESE
	Elective	GLY-304 OR GLY-305	GEOLOGY OF INDIA-I OR QUATERNARY GEOLOGY AND PALEOCLIMATE	Theory Theory	2 2	CE+ESE CE+ESE
		GLY-306 OR GLY-307	GEOMORPHOLOGY AND REMOTE SENSING OR PRINCIPLES OF GEOCHEMISTRY	Theory Theory	2 2	CE+ESE CE+ESE
	Major	GLY-311	GEOLOGY PRACTICAL-5	Practical	2	CE+ESE
		GLY-312	GEOLOGY PRACTICAL-6	Practical	2	CE+ESE
	VSC	GLY-331	HYDROGEOLOGY	Theory	2	CE
		GLY-332	GEOLOGY PRACTICAL-7	Practical	2	CE
	Minor	GLY-321	PALAENTOLOGY	Theory	2	CE+ESE
	FP	GLY-345	FIELD PROJECT	Theory / Practical	2	CE
	Major	GLY-351	ECONOMIC GEOLOGY	Theory	2	CE+ESE
		GLY-352	INTRODUCTION TO OCEANIC AND ATMOSPHERIC SCIENCES	Theory	2	CE+ESE
		GLY-353	STRUCTURAL	Theory		CE+ESE

VI			GEOLOGY			
	Elective	GLY-354 OR GLY-355	GEOLOGY OF INDIA-II OR ENVIRONMENTAL GEOLOGY	Theory Theory	2 2	CE+ESE CE+ESE
		GLY-356 OR GLY-357	PETROLEUM GEOLOGY OR SOIL GEOLOGY	Theory Theory	2 2	CE+ESE CE+ESE
	Major	GLY-361	GEOLOGY PRACTICAL-8	Practical	2	CE+ESE
		GLY-362	GEOLOGY PRACTICAL-9	Practical	2	CE+ESE
	VSC	GLY-382	GEOLOGY PRACTICAL-10	Practical	2	CE
	Minor	GLY-371	APPLIED GEOLOGY	Theory	2	CE+ESE
	OJT	GLY-395	ON JOB TRAINING	Theory / Practical	4	CE

**OE – Open Elective, SEC- Skill Enhancement Course, VSC- Vocational Skill Course, CEP- Community Engagement Program, FP- Field Project, OJT-On Job training*

Teaching and Evaluation (Only for FORMAL education courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	3 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Eligibility: As per the rules and regulations of Savitribai Phule Pune University (SPPU)

T. Y. B. Sc. Semester-V		
	GLY-301-Mineralogy **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall principles associated with optics, physical and optical mineral properties.	1
CO2	Compare various mineral groups on the basis of physical and optical mineral properties along with their paragenesis	2
CO3	Apply the knowledge of minerals to understand their formation processes.	3
CO4	Classify crystals into different systems	4
CO5	Determine minerals on the basis of optical characters.	5
CO6	Compile mineral data by using physical and optical properties.	6

Unit No.	Title of Unit and Contents	No. of Hours
I	**Crystallography, Optics and non-silicate minerals** Crystallography-Definition of a crystal. External and internal imperfections in crystals,Growth of crystals in cavities, Study of Cubic system (Type- Pyrite &Type- Tetrahedrite), Study of Hexagonal system (Type- Calcite, Type-Quartz & Type-Tourmaline), Twinning: Definition, causes, parts of twins, types of twins, laws of twinning. Optics-Refractive index and its comparison with Becke line, shadow method and immersion method, Scheme of Pleochroism, Phenomemon of isotropism, anisotropism, extinction and interference colours,Accessory plates: Mica plate, Gypsum plate and quartz wedge, Sign of elongation in minerals, Uniaxial and biaxial indicatrices Study of the following non-silicate minerals with respect to their chemical composition, properties and uses Oxides: Ilmenite, Rutile and Limonite, Sulphides: Sphalerite, Galena,Sulphates: Gypsum and Baryte, Carbonates: Aragonite, Rhodochrosite and Siderite, Phosphates: Apatite, Monazite, Halides: Fluorite and Halite	**15**

II	**Study of silicate mineral groups** Study of silicate mineral groups with reference to their silicate structure, chemical composition, physical & optical properties, paragenesis and alteration products - Olivine group, Pyroxene group, Amphibole group, Mica group, Clay mineral group, Feldspar group, Felspathoid group, Garnet group, Aluminosilicate group	**15**

Learning Resources- References

Sr. No.	References
1.	Berry and Mason (1961) Mineralogy. W. H. Freeman & Co.
2.	Perkin D. (2010) Mineralogy, Pearson
3.	Deer, Howie and Zussman (1996) Introduction to Rock Forming Minerals, Pearson
4.	Kerr, B.F., (1995) Optical Mineralogy 5th Ed. McGraw Hill, New York
5.	Dana, E. S. and Ford, W. E., (2002) A textbook of Mineralogy (Reprints).
6.	Read, H. H., (1968) Rutley's Element of Mineralogy (Rev. Ed.), Thomas Murby and Co.

	GLY-302-Igneous and Metamorphic Petrology **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall textural and mineralogical characters of igneous and metamorphic rocks	1
CO2	Catagorize igneous and metamorphic rocks on the basis of physical and optical properties.	2
CO3	Examine and classify igneous and metamorphic rocks.	3
CO4	Analyze ACF and Norm data	4
CO5	Compare different metamorphic facies, igneous rock kindreds and provinces.	5
CO6	Prepare a report about the rock samples collected from the field.	6

Unit No.	Title of Unit and Contents	No. of Hours
I	**Igneous Petrology** Types of Magma: Primary and derivative Crystallization of Magma: Phase rule, Unicomponent magma, Bicomponent magma, Eutectic Crystallization, Solid solution series, Binary magma with an incongruent melting compounds: Leucite - silica system. Ternary system: Albite - Anorthite - Diopside system, 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 Description of Igneous Rocks and Migmatites	**15**
II	**Metamorphic Petrology** Metamorphism as a process and types of metamorphism, Concept and processes of Thermal Metamorphism, Dynamic / Cataclastic Metamorphism, Regional Metamorphism-Metamorphic Reconstitution, Barrowian zones and Metamorphic facies, Pnuematolysis or Metasomatism	**15**

Learning Resources- References

Sr. No.	References
1.	Turner and Verhoogen (1951) Igneous and metamorphic Petrology, McGraw-Hill.
2.	Elher and Blatt (1982) Igneous, metamorphic and sedimentary Rocks, Freeman.
3.	John D. Winter (2010) Principles of Igneous and Metamorphic Petrology, Prentice Hall.
4.	Tyrrell G. W. (1978) Principles of Petrology, Springer
5.	Bruce Yardley and Clare Warren (1991) Introduction to Metamorphic Petrology, Longman
6.	M. Wilson (2007) Igneous Petrogenesis, Springer

	GLY-303-Engineering Geology **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe the concepts of engineering geology and outline the applications of geology in engineering projects.	1
CO2	Discuss various engineering properties of rocks and aggregates.	2
CO3	Apply the knowledge of various engineering properties of rocks in engineering projects.	3
CO4	Explain the types of raw materials used in engineering projects.	4
CO5	Evaluate data related to engineering classification of rocks.	5
CO6	Compile geological data based on various case studies related to site selection of engineering structures.	6

GLY-303-Engineering Geology
(Major-Theory)

Unit No.	Title of Unit and Contents	Number of Hours
I	**Engineering properties and classification of rocks** **Engineering properties of rocks:** Introduction to Engineering Geology, Applications of geology in engineering projects, Importance of weathering and clay formations, Engineering properties rocks, Factors controlling the engineering properties of rock, Aggregates and its type **Engineering classification of rock:** Rock Quality Designation (RQD), Rock Mass Rating System (RMRS), Rock Structure Rating (RSR), Rock Quality Index System (Q-System), Geological Strength Index (GSI) and Rock Mass Cutting Index (RMCI), Stability of slopes	**15**
II	**Geological factors for site selection of various infrastructures** **Tunnels:** Types of tunnels and geological factors affecting tunnelling, Overburden, Case study **Dams and Reservoirs:** Types of dams and reservoirs, Geological factors for site selection of dam and reservoir, Case study **Bridges:** Types of bridges, Geological factors for site selection of bridges, Case study **Ground improvement and preventive measures**	**15**

Learning Resources- References

Sr. No.	References
1.	Gokhale, K. V. G. (2006) Principles of Engineering Geology, BS Publication
2.	Krynine, D. P. and Judd, W. R. (2005) Principles of Engineering Geology and Geotechniques, CBS Publishers & Distributors.
3.	Blyth, F. G. H. and M. H. de Freitas (1984) Geology for Engineers, Butterworth Heinemann Title
4.	Engineering Geology, (2013): Parbin Singh, S. K. Kataria & Sons
5.	Ries, H. and T. L. Watson, (1949) Elements of Engineering Geology, New York, John Wiley & Sons, Inc.
6.	Tony Waltham (2009) Foundations of Engineering Geology, Taylor, and Francis.
7.	Chenna Keshvallu (2018) Textbook of Engineering Geology, Laxmi Publications.

	GLY-304-Geology of India-I **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall principles of stratigraphy, geological time scale and elements of continents and oceans.	1
CO2	Explain the criteria used in developing the Precambrian Stratigraphy of India.	2
CO3	Classify cratons, mobile belts and platform basins of India on the basis of lithological and stratigraphic characters	3
CO4	Compare various cratons, mobile belts and platform basins of India.	4
CO5	Determine economic importance of Precambrian stratigraphic units of India.	5
CO6	Prepare a report on rock samples collected from various stratigraphic horizons.	6

GLY-304-Geology of India-I
Elective-Theory

Unit No.	Title of Unit and Contents	No. of Hours
I	**Introduction to Indian and World Precambrian History and Precambrian rocks of Peninsular India** World Precambrian history in brief - Cratons and mobile belts of the world, General review of Indian Stratigraphy, Cratons of India and associated Proterozoic basins Craton wise broad stratigraphy, correlation and other aspects - Dharwar Craton, Singbhum - Odisha Iron Ore Craton, Central Indian Craton / Bastar Craton, Aravalli Craton, Bundelkhand Craton	**15**
II	**Precambrian rocks of Extra-Peninsula, Precambrian mobile belts and Precambrian sedimentary basins of India** Precambrian rocks of Extra-Peninsula -Tectono-stratigraphic divisions of Himalaya, Vaikrita Group, Juthog Group and Shali Group. Precambrian mobile belts of India - Eastern Ghat Mobile Belt, Satpura Mobile Belt / CITZ (Central Indian Tectonic Zone), Pandyan Mobile Belt. Stratigraphy and Economic Importance of – Aravalli Supergroup, Delhi Supergroup, Vindhyan Supergroup, Cuddapah Supergroup, Kaladgi Supergroup, Chhattisgarh Supergroup.	**15**

Learning Resources- References

Sr. No.	References
1.	Ramakrishnan M, and Vaidynadhan, R (2010) Geology of India, Geological Society of India Publication, Bangalore. Vol. I
2.	Valdiya K. S. (2010) The Making of India: Geodynamic Evolution, Springer
3.	Ravindrakumar (2018) Fundamentals of Historical Geology and Stratigraphy of India, Newage Publications.
4.	Krishnan, M. S. (1982) Geology of India and Burma, 6th Edition. CBS Publ.

	GLY-305 Quaternary Geology and Paleoclimate **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall the concepts of Quaternary Geology.	1
CO2	Explain the Quaternary Stratigraphic concepts.	2
CO3	Apply the various principles of science in understanding of various Quaternary dating methods.	3
CO4	Analyse the responses of climate to the geomorphic systems	4
CO5	Evaluate the impact of quaternary period climate on the evolution of man and other life forms.	5
CO6	Compile the quaternary data to understand the Quaternary history of Earth.	6

GLY-305 Quaternary Geology and Paleoclimate
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Introduction to Quaternary Geology** Overview of Quaternary Geology and Concepts Quaternary Stratigraphy- Oxygen Isotope stratigraphy, Biostratigraphy, Magneto-stratigraphy. Quaternary dating methods- Radiocarbon, Uranium series, Oxygen Isotopes, Luminescence and Amino acid. Quaternary climates -Glacial-interglacial cycles, Eustatic changes, Proxy indicators of palaeo-environmental / palaeo-climatic changes, - land, ocean and cryosphere (ice core studies).	**15**
II	**Quaternary Sequences** Geomorphic System and climates- Responses of geomorphic systems to climate, sea level, Tectonics on variable time scales in the Quaternary Period. Evolution in Quaternary Period- Evolution of man and Stone Age cultures, Plant and animal life in relation to glacial and interglacial cycles during Quaternary. Quaternary Stratigraphy of India- Continental records, Marine records, Continental-marine correlation of Quaternary record.	**15**

Learning Resources- References

Sr. No.	References
1.	Narayana AC (2002), Late Quaternary Geology of India and Sea Level Changes, Geological Society of India
2.	Lowe, J. J. & Walker, M. J. C.(1997), Reconstructing Quaternary Environments Longman,
3.	D. Q. Bowen (1978), Quaternary Geology: A Stratigraphic Framework for Multidisciplinary Work, Elsevier Science & Technology Books
4.	Raymond S. Bradley (2015), Paleoclimatology: Reconstructing Climates of the Quaternary, Academic Press
5.	Atanu Bihari Goswami (2014), Principles of Quaternary Geology and Environment Study: Concept, Methodology and Technique, Roman Books

	GLY-306 Geomorphology and Remote Sensing **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify various photo recognition elements from remotely sensed data.	1
CO2	Discuss various geomorphic features, lithologies and structural elements from remotely sensed data.	2
CO3	Apply remote sensing principles and photo recognition elements to identify various features.	3
CO4	Analyze remotely sensed data to draw conclusions regarding geological history of an area.	4
CO5	Compare between different types of remotely sensed data and evaluate its utility.	5
CO6	Assemble remote sensing and geomorphological data and prepare a report.	6

GLY-306 Geomorphology and Remote Sensing
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Geomorphology and Principles of Remote Sensing** **Geomorphology -** Introduction to geomorphic concepts, Landforms: role of lithology, endogenous and exogenous processes, climatic and tectonic forces, Study of different landforms, Introduction to Geomorphic Indicators of Active Tectonics (GAT indices) **Remote Sensing-** Principles of Remote Sensing - 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	**15**

II	**Photogeology, Satellites and Satellite data** **Photogeology** - Aerial Photography, Classification and planning of aerial photographs, Discrepancies in aerial photographs, Geometric characteristics of aerial photos, Stereoscopy, Photo recognition elements, Photo-geological interpretations of lithology and structure, Use of drones for remote sensing **Satellites and Satellite data** - Introduction to Satellites, Sensors & their applications, Brief history, Types of Satellites (Orbital Characteristics, Sensors and applications with reference to latest IRS & Landsat: Landsat 8 and 9, IRS satellites - Oceansat, Cartosat, Resourcesat, IRNSS), Scanners - Hyperspectral Scanners, Active remote sensing systems - RADAR and LIDAR (Principles & applications)	**15**

Learning Resources- References

Sr. No.	References
1.	Kale V. S. and Gupta A. (2001) Introduction to geomorphology, Orient Longman
2.	Thornbury W. D. (1954), Principles of Geomorphology, Wiley
3.	Lillesand T. M., Kiefer R. W. and Chipman J. (2015) Remote Sensing and Image Interpretation, Wiley
4.	Drury S. A. (1990) A Guide to Remote Sensing - Interpreting Images of Earth, Oxford
5.	Pandey S. N. (2001) Principles and Applications of Photogeology, New Age International
6.	https://www.usgs.gov/core-science-systems/nli/landsat
7.	https://www.iirs.gov.in

	GLY- 307-Principles of Geochemistry **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall the salient features of the Periodic table and its constituents	1
CO2	Explain the Nucleosynthesis, Cosmic Abundance of elements	2
CO3	Apply the laws of thermodynamics in Geochemistry	3
CO4	Compare the various Geochemical cycles	4
CO5	Interpret and represent the Geochemical data	5
CO6	Choose the appropriate geochemical analysis method and minerals	6

GLY- 307-Principles of Geochemistry
Elective Theory

Unit No.	Title of Unit and Contents	No. of Hours
I	**Concepts in Geochemistry** 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**

II	**Applications of Geochemistry in different Petrologies** Igneous Petrology- 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 Sedimentary Petrology- 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 Metamorphic Petrology- Geochemistry of Stability of minerals, Geochemistry of Metasomatism, Metamorphic reactions - concepts, ACF, AKF and AFM diagrams, Applications of analytical techniques such as EPMA in Metamorphic Petrology	**15**

Learning Resources- References

Sr. No.	References
1.	William M. White (2013), Geochemistry, Willey Publication
2.	Mason, B., & Moore, C. B. (1982), Principles of Geochemistry, John Wiley and Sons
3.	Zachary Sharp (2007), Principles of Stable Isotope Geochemistry, Pearson/Prentice Hall
4.	Giulio Ottonello (2000), Principles of Geochemistry, Columbia University Press
5.	Kula C. Misra (2012), Introduction to Geochemistry: Principles and Applications, John Wiley & Sons
6.	William M. White (2015), Isotope Geochemistry, John Wiley & Sons
7.	Gunter Faure (1998), Principles and Applications of Geochemistry: A Comprehensive Textbook for Geology Students, Prentice Hall

	GLY-311-Geology Practical -5 **Major**	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify megascopic and microscopic and describe various engineering properties of rocks.	1
CO2	Infer standard parameters from twinned crystals	2
CO3	Classify different crystals on the basis of hemimorphic and hemihedral forms	3
CO4	Compare between crystals within Cubic system and Hexagonal system.	4
CO5	Determine RQD from given data and critique about site selection for construction of engineering structures from geological data.	5
CO6	Generate the axial ratios of crystals from given data.	6

GLY-311-Geology Practical -5
(Major-Practical)

Expt. No.	Title of Experiment
1	Study of megascopic properties of minerals
2	Study of megascopic properties of minerals
3	Study of microscopic properties of minerals
4	Optics - R. I. and Sign of elongation
5	Crystallography - Study of Cubic System Type - Pyrite and Tetrahedrite
6	Crystallography - Study of Hexagonal System Type Calcite, Quartz and Tourmaline
7	Study of Twin Crystals
8	Calculate Axial Ratios from given data
9	Site suitability for construction of large engineering projects.
10	Preparation of subsurface map, correlation and interpretation for construction of large engineering Projects - I
11	Preparation of subsurface map, correlation and interpretation for construction of large engineering Projects - II
12	Study of physical and engineering properties of rocks.
13	Study of physical and engineering properties of rocks.
14	Revision
15	Revision

	GLY-312 Geology Practical -6 **Major** **Practical**	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall different rock textures and structures.	1
CO2	Categorize various megascopic and microscopic rocks using physical and optical properties.	2
CO3	Examine different rocks in hand specimen.	3
CO4	Compare the stratigraphy of various Precambrian units of India.	4
CO5	Determine nature of protolith by ACF diagrams	5
CO6	Perform CIPW Norm calculation for silica saturated igneous rocks.	6

Expt. No.	Title of Experiment
1	Megascopic study of various igneous structures.
2	Megascopic study of various igneous rocks.
3	Megascopic study of various igneous rocks.
4	Microscopic study of various textures and structures of igneous rocks
5	Microscopic study of various textures and structures of igneous rocks
6	Microscopic study of various igneous rocks.
7	Megascopic study of various metamorphic rocks.
8	Megascopic study of various metamorphic rocks.
9	Microscopic study of various metamorphic rocks.
10	Problems related to CIPW Norm calculation for silica saturated igneous rocks
11	Plotting of Chemical Composition of Metamorphic rocks on ACF diagrams.
12	Study of maps showing geographical distribution of the various Precambrian stratigraphic units of India
13	Study of maps showing geographical distribution of the various Precambrian stratigraphic units of India
14	Revision
15	Revision

	GLY-331-Hydrogeology **VSC** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe the status of groundwater in India and the world.	1
CO2	Discuss basic concepts related to fluid motion in porous media.	2
CO3	Illustrate the concept of aquifers and their boundaries.	3
CO4	Compare the status of groundwater in various physiographic divisions of India.	4
CO5	Determine appropriate techniques for hydrogeological survey.	5
CO6	Perform hydrogeological surveys and prepare field reports.	6

GLY-331-Hydrogeology
(VSC-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Introduction to hydrogeology, groundwater accumulation, movement and aquifers** Definition - Hydrology, Hydrogeology, Groundwater and the hydrologic cycle, Groundwater as a resource, Groundwater crises, Global groundwater scenario, Indian groundwater scenario and scope and groundwater development in India Vertical distribution of groundwater, Origin of groundwater and rock properties affecting groundwater, Groundwater accumulation, Groundwater movement (Darcy's law Aquifers, Types of aquifers, Springs and conditions for formation of springs, types of springs Groundwater and surface water - Base flows, stream flow	**15**

II	**Groundwater Problems, Field Techniques and Groundwater in India** **Ground Water Problems -** Introduction to water quality and groundwater pollution, Saline water ingress, Groundwater overexploitation **Field Techniques -** Groundwater level measurement and analysis, use of isotope studies, weather parameters and measurement and analysis, introduction to pumping tests and slug tests, introduction to groundwater modelling techniques **Groundwater in India** - Groundwater provinces of India (Case studies), Groundwater agencies in India (Government agencies and NGO's), Groundwater assessment in India and Introduction to Groundwater Development and Management	**15**

Learning Resources- References

Sr. No.	References
1.	Todd D. K. (2007) Groundwater Hydrology, Wiley.
2.	Freeze R. A. and Cherry J. A. (1979) Groundwater, Prentice Hall.
3.	Fetter C. W. (2018) Applied Hydrogeology, Waveland Press.
4.	Brassington R. (2017) Field Hydrogeology, Wiley Blackwell
5.	Raghunath, H. M. (1987) Groundwater, New Age International
6.	www.acwadam.org publications
7.	Price Miachel (1996) Introducing Groundwater, 2nd Edition, Chapman and Hall

	GLY-332 Geology Practical -7 **VSC** **Practical**	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify relation between rainfall and groundwater levels from given data.	1
CO2	Compute the scale of aerial photographs and base flow contribution from given stream flow data	2
CO3	Examine different remote sensing data using photo recognition elements and calculate specific capacity of wells from pumping test data	3
CO4	Analyze lineament orientations from given remote sensing data and groundwater quality using various methods	4
CO5	Measure different morphometric parameters in a given drainage basin and determine recharge and discharge areas of groundwater from given data.	5
CO6	Compile observations from satellite images and aerial photos and construct water table contours from well inventory data.	6

GLY-332 Geology Practical -7
(VSC- Practical)

Expt. No.	Title of Experiment
1	Morphometry - Drainage basin analysis
2	Morphometry - Drainage basin analysis
3	Problems related to scale of aerial photographs and relief displacement
4	Problems related to scale of aerial photographs and relief displacement
5	Geomorphic, lithological and structural interpretations from aerial photographs
6	Interpretation of Satellite Images
7	Lineament analysis
8	Preparation of hydrographs using rainfall, water level data or spring discharge data
9	Preparation of water table contours to understand flow direction of groundwater and to demarcate recharge and discharge areas
10	Pumping test analysis for specific capacity of wells (Slichter's method)
11	Pumping test analysis for specific capacity of wells (Slichter's method)
12	Groundwater quality analysis using Piper's plot
13	Analysis of stream flow data for base flow calculations
14	Revision
15	Revision

	GLY-321-Palaeontology (Minor-Theory)	
	Number of Credits:02 Number of Hours:30	
Course Outcomes (Cos) On completion of the course, the students will be able to:		**Bloom's cognitive level**
CO1	Describe various processes involved in the formation of fossils.	1
CO2	Classify various types of fossils on the basis of their morphological features.	2
CO3	Examine fossils in hand specimens or under microscope.	3
CO4	Explain significance of fossils in the interpretation of depositional environments.	4
CO5	Compare fossils belonging to various phyla.	5
CO6	Prepare a report on fossil samples collected during the study tour.	6

GLY-321-Palaeontology
(Minor-Theory)

Unit No.	Title of Unit and Contents	Number of Hours
I	**Introduction to Palaeontology and Invertebrate Palaeontology** Palaeontology: Definition, branches, Importance and scope. Fossils: Definition, conditions and modes of preservation of fossils, Techniques used in collection (Spot and channel), preservation and illustration of mega fossils, Uses and Importance of fossils, Mass extinction, causes and evidence Systematic position, morphology of hard parts, geological and geographical distribution of the following: **Phylum Mollusca:** Class Lamellibranchia or Bivalvia: Morphology of hard parts of the shell, ornamentation and types of hinge lines, Class Gastropoda: Morphology of hard parts of the shell and forms of the gastropod shell, Class Cephalopoda: Morphology of hard parts of Nautilus, Ammonoids, Belemnites and type of suture lines. Comparison between Nautilus and Ammonoids. Evolutionary trends in Ammonoids Systematic position, morphology of hard parts, geological and geographical distribution of the following: **Phylum Brachiopoda** Morphology of hard parts of Class Articulata and Inarticulata. Types of brachial skeleton, Comparison between Lamellibranchs and Brachiopods. **Phylum Echinodermata** Class Echinoidea: Morphology of hard parts of Regularia. Variation in the apical disc in echinoids. **Phylum Arthropoda**	**15**

	Class Trilobita – Morphology of hard parts of Trilobites and evolutionary trends. **Phylum Coelenterata** Class Anthozoa- Madreporaria, polyp, medusa, types of septa. Origin and evolution of life over geological time. Concepts of organic evolution. (Definition, Evidence of evolution, Macro & Micro evolution, Darwinism, Lamarckism & Mutation)	
II	**Micropalaeontology, Palaeobotany and Ichnology** **Micropalaeontology** Introduction to Micropalaeontology, Definition, different types of microfossils, their size range and composition Different branches of Micropalaeontology, uses of microfossils Field and Laboratory Techniques Field techniques for collection of microfossils (sampling methods), Laboratory techniques for separation- Mechanical and chemicals methods, Recovery of microfossils from shale and limestone. Separation of microfossils from coal (maceration), Preservation and Illustration. Study of the following microfossils: (with respect to their morphology, environmental and paleo-ecological significance) Foraminifers, Ostracods, Diatoms and Radiolarian **Palaeobotany** Introduction to Palaeobotany, Classification of Plants, preservation of parts of plants, Study of Pollens and Spores **C) Ichnology** Ichnofossils its classification, significance	**15**

Learning Resources- References

Sr. No.	References
1.	Woods, H., 1958, Text Book of Palaeontology (Invertebrate), Cambridge University Press, UK.
2.	Clarkston E.N.K., 1998, Invertebrate Palaeontology and Evolution, 4th Edition, Wiley – Blackwell, 468p.
3.	Brasier, M.D., 2011, Microfossils, Chapman & Hall, 193p.
4.	Remer: Vertebrate Palaeontology.

T. Y. B. Sc. Semester-V		
	GLY-345 Field Project (Theory/Practical)	
	Number of Credits:02 **Number of Hours:60**	

T. Y. B. Sc. Semester-VI		
	GLY-351-Economic Geology **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe various ore minerals on the basis of their physical and chemical properties.	1
CO2	Discuss various processes involved in ore formation.	2
CO3	Outline the information about the geographical occurrence of different ores in India.	3
CO4	Compare various metallic and non-metallic deposits.	4
CO5	Justify occurrence of metallic and non-metallic deposits in an area on the basis of geological parameters	5
CO6	Prepare a report about metallic and non-metallic deposits collected from the field.	6

GLY-351-Economic Geology
(Major-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Basics of economic geology and processes of formation of mineral deposits** Introduction- Ore, gangue, tenor, syngenetic and epigenetic deposits, Classification of metalliferous and non-metalliferous deposits. Processes of formation of mineral deposits- Primary Processes- Magmatic concentration and Hydrothermal Process; Secondary Processes - Oxidation and Supergene enrichment, Evaporation, Residual concentration and Mechanical concentration	**15**

II	**Study of metallic and non-metallic deposits** Study of following metallic deposits with reference to their mode of occurrence, mineralogy, properties, uses, geological and geographical distribution- Precious metals, non-ferrous metals and iron and ferro alloy metals. Study of following non-metallic mineral deposits with reference to mode of occurrence, properties and uses- Industrial and manufacturing materials, chemical minerals, fertilizer minerals, abrasives & abrasive minerals and refractory minerals. Study of Radioactive minerals Coal - origin, varieties, mode of occurrence, coal deposits in India (Raniganj and Bokaro), coal fields of Maharashtra	**15**

Learning Resources- References

Sr. No.	References
1.	Jeason and Bateman (1981) Economic mineral deposits, John Wiley and Sons.
2.	Gokhale &Rao (1978) Ore deposits of India, Thomson press (India) limited.
3.	Umeshwar Prasad (2003) Economic Geology, Satish Kumar Jain, CBS Publishers and Distributers.
4.	Krishnaswamy, Subbier (1979) India's mineral resources, 2nd edition: New Delhi, Oxford and IBH Publishing
5.	D. N. Wadia (1966) India’s Minerals, National Book Trust
6.	Robert L. Bates (1969) Geology of the Industrial Rocks & Minerals, Dover Publications
7.	Economic mineral deposits of India by Umate (IBM)
8.	Park & McDermitt (1997) Economic Ore Deposits
9.	Reports of IBM, DGM, GSI and MECL

	GLY-352 Introduction to Oceanic and Atmospheric Sciences **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define structure of atmosphere and oceans.	1
CO2	Discuss basic concepts related to oceanic and atmospheric circulation.	2
CO3	Illustrate the concept of Coupled Ocean-Atmosphere Systems.	3
CO4	Analyse the types of clouds and oceanic floor features.	4
CO5	Review greenhouse effect, climate change and related concepts.	5
CO6	Compile different types of climate change related data.	6

GLY-352 Introduction to Oceanic and Atmospheric Sciences
(Major-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Oceans:** Hypsography and Provinces of Ocean Physical and chemical properties of sea water and their spatial variation Residence time of elements in ocean water Thermohaline circulation Major water masses of the world's oceans **Atmosphere**: Composition and structure of atmosphere Coriolis effect Circulation Cells Insolation and heat budget of Earth Cloud formation and precipitation processes Types of clouds	**15**

II	**General weather system of Indian subcontinent**: NE and SW Monsoon Jet stream Cyclones Western disturbances Distribution of precipitation over India Rock forming processes in ocean Subtropical Gyres Greenhouse effect El-Niño Southern oscillations (ENSO)	**15**

Learning Resources- References

Sr. No.	References
1.	Trujillo, A. and Thurman, H. (2019) Essentials of Oceanography, Prentice Hall
2.	Wallace, J. M. and Hobbs, P. V. (2006) Atmospheric Sciences: An introductory Survey, Elsevier Science
3.	Marshall, J. and Plumb, A. R. (2008) Atmosphere, Ocean and Climate Dynamics: An Introductory Text, Academic Press
4.	Albert Defant (1961), Physical Oceanography, Pergamon Press

	GLY-353-Structural Geology **Major** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall description associated with various structures and basic concepts of plate tectonics.	1
CO2	Compare different types of rock deformations.	2
CO3	Apply the mechanical principles to understand formation of structures	3
CO4	Analyse the structural data.	4
CO5	Evaluate the structural data.	5
CO6	Prepare and validate the field structural data by using various structural analyses.	6

GLY-353-Structural Geology
(Major-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Rock Deformation I** Fundamental concepts of deformation, Definition of plastic, ductile deformation, brittle Factors controlling rock deformation, Behaviour of different minerals under stress, Behaviour of rocks in confined and unconfined conditions, Stress & Strain ellipsoid	**15**
II	**Rock Deformation II** Mechanisms of brittle deformation - Fractures and faults, Mechanisms of plastic deformation - Folds and Folding, Foliation and cleavage, Lineation and Linear structures Shear zones - Brittle, Semi brittle, Ductile Descriptive Analysis of structures - fault, joint and fold analysis, geometric analysis of folds, Analysis of deformation history from deformed rocks	**15**

Learning Resources- References

Sr. No.	References
1.	Billings, M. P. (1942) Structural Geology, Prentice Hall,
2.	George H. Davis, Stephen J. Reynolds and Chuck Kluth (1984) Structural Geology of Rocks and Regions, John Wiley.
3.	R. G. Park (1982) Foundations of Structural Geology, Blackie
4.	Fossen H, 2010 – Structural Geology, Cambridge University Press, 1st edition
5.	Jain, A.K., (2014) An introduction to structural geology. Textbook series in Geological Sciences for Graduate Students, Geological Society of India, Bangalore

	GLY-354-Geology of India II **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall principles of stratigraphy and geological time scale giving special emphasis on Phanerozoic Eon	1
CO2	Discuss the criteria used in developing the Phanerozoic Stratigraphy of India.	2
CO3	Classify Palaeozoic, Mesozoic and Cenozoic Systems or Groups on the basis of lithology, stratigraphic characters and boundary problems.	3
CO4	Compare the various events during Phanerozoic Eon.	4
CO5	Determine the economic importance of rocks associated with various Phanerozoic basins of India.	5
CO6	Prepare a report on rock samples collected from various stratigraphic horizons.	6

GLY-354-Geology of India II
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Introduction to Phanerozoic Stratigraphy and Palaeontology** Stratigraphic Boundary Problems - Introduction to Geological systems with reference to their global type area, Precambrian-Cambrian boundary, Permo-Triassic Boundary, Cretaceous-Palaeogene Boundary, Palaeogene-Neogene Boundary Palaeontology - Morphology, Classification & distribution of Graptolites, Gondwana Flora, Mass extinctions, Phanerozoic Stratigraphy of Extra - Peninsular India-Classification, lithological succession and fossil content	**15**
II	**Phanerozoic Stratigraphy of Peninsular India –** Palaeozoic Formations of Peninsular India, Mesozoic Formations of Peninsular India, Cenozoic Formations of Peninsular India, Deccan Volcanic Province, Stratigraphy of Maharashtra in brief	**15**

Learning Resources- References

Sr. No.	References
1.	Vaidynadhan, R and Ramakrishnan, M (2010) Geology of India, Geological Society of India Publication, Bangalore. Vol. II
2.	Valdiya K. S. (2010) The Making of India: Geodynamic Evolution, Springer
3.	Ravindra Kumar (2018) Fundamentals of Historical Geology and Stratigraphy of India, New Age Publications.
4.	Krishnan, M. S. (1982) Geology of India and Burma, 6th Edition. CBS Publ.

	GLY-355-Environmental Geology **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall the concept of Environmental Geology and Geogenic disaster.	1
CO2	Discuss the various types of pollution.	2
CO3	Analyse the various environmental issues by taking remedial measures.	3
CO4	Explain the concept of Environmental Impact Assessment.	4
CO5	Classify the geogenic disaster and evaluate Geogenic disaster prone area.	5
CO6	Prepare a report on any geogenic disaster prone area.	6

GLY-355-Environmental Geology
(Elective-Theory)

Unit No.	Title of Unit and Contents	Number of Hours
I	**Environmental Geology** Scope, Concepts and Objectives of Environmental Geology Physical, Biological and Socio-geological Environment, Bio-geochemical cycles. Types of Pollution: Air, Water and Soil Pollution Conservation of Natural Resources Solid Waste Management: Generation, Collection, Segregation, Characterization, Disposal, Recycling and Reuse, Its effect with geological perspective. Urban Geology	**15**
II	**Geogenic disasters and hazards** Definition, type, risk, distinction between hazard and disaster Natural hazard zonation maps, Risk, Vulnerability, Mitigation, etc. Role of Geologist in disaster management plan Geogenic hazards: Earthquake, Volcanoes, Cyclones, Floods, Mass movements, Coastal erosion Environmental Impact Assessment	**15**

Learning Resources- References

Sr. No.	References
1.	Valdiya, K.S., (1987) Environmental Geology-India.Context.Tata McGraw Hill New Delhi.
2.	Keller, E.A. (2000) Environmental Geology. Shales E. Merril Publishing Co., Columbus, Ohio.
3.	Montgomery, C., (1984) Environmental Geology. John Wiley and Sons, London.
4.	Bird, Eric, (2000) Coastal Geomorphology: An Introduction. John Wiley & Sons, Ltd. Singapore.
5.	Liu, B.C., 91981) Earthquake Risk and Damage, Westview.
6.	Sharma J. P., Environmental Studies, Laxmi Publications(P) Ltd, New Delhi UGC Document on LOCF Geology 42
7.	Urban Geology: Geology & cities.
8.	Environmental Impact Assessment by Raman, Gajbhiye and Khandeshwar (2019)

	GLY-356 Petroleum Geology **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe occurrence and distribution of petroleum within rocks.	1
CO2	Explain the origin, migration and accumulation of petroleum	2
CO3	Classify various reservoirs and traps.	3
CO4	Categorise various types of petroliferous basins of India.	4
CO5	Evaluate geological occurrences of petroleum.	5
CO6	Organise the geological data from various petroliferous basins.	6

GLY-356 Petroleum Geology
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Petroleum Geology - I** - Occurrence of petroleum, nature of source rock, Reservoir and Traps, Origin, migration and accumulation of petroleum	**15**
II	**Petroleum Geology - II** - Classification and composition of petroleum products Physical properties of petroleum, composition of biomass, Kerogen - Composition and types, Petroliferous basins of India and the world	**15**

Learning Resources- References

Sr. No.	References
1.	Levorsen, A. I., (2004) Geology of Petroleum, CBS Publishers and Distributors
2.	Selley, R. C., (1998) Elements of Petroleum Geology: W.H. Freeman & Company, NewYork
3.	Deshpande, B. G. (2009) The world of Petroleum, New Age International, New Delhi

	GLY-357-Soil Geology **Elective** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Define the soil science characteristics of soil.	1
CO2	Explain the various soil horizons.	2
CO3	Identify the various minerals in soil and apply the soil sciences in various fields.	3
CO4	Classify the various soils on the basis of their genesis.	4
CO5	Interpret the soil data.	5
CO6	Create the soil map on the basis of physicals and chemical characteristics of various soils.	6

GLY-357-Soil Geology
(Elective-Theory)

Unit No.	Title of Unit and Contents	No. of Hours
I	**Introduction to Soil Geology** Introduction- Definition, Morphology and physical characteristics of soil, Horizons of Soil Soil Characters- 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). Soil Genesis- Parent Materials, Weathering, Pedoturbation, Role of organisms in soil genesis, Models and concepts of soil formation	**15**
II	**Applications of soil geology** Soil Analysis- 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, Sampling Techniques, Classification and mapping of the soils, Indian Soils	**15**

Learning Resources- References

Sr. No.	References
1.	Randall J. Schaetzl, Sharon Anderson (2005), Soils: Genesis and Geomorphology, Cambridge University Press
2.	Joseph Alfred Zinck, Graciela Metternicht, Gerardo Bocco, Héctor Francisco Del Valle (2016), Geopedology: An Integration of Geomorphology and Pedology for Soil and Landscape Studies, Springer International Publishing
3.	Pan Ming Huang, Yuncong Li, Malcolm E. Sumner (2018), Handbook of Soil Sciences (Two

	Volume Set), CRC Press
4.	W. L. Schroeder, Stephen Dickenson Soils in Construction (2019), Waveland Press.

	GLY-361-Geology Practical -8 **(Major- Practical)**	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe various structural features on the basis of geometrical data.	1
CO2	Compute reduced level of a bore hole from given data.	2
CO3	Interpret given geological map of an area and construct a cross section.	3
CO4	Compare the stratigraphy of various Phanerozoic units of India and examine plant fossils in hand specimen.	4
CO5	Measure plunge and rake of a linear structural feature by geometric and stereographic methods	5
CO6	Prepare a geological map from given data.	6

Expt. No.	**Title of Experiment**
1	Study of geological maps with folded beds - I
2	Study of geological maps with folded beds - II
3	Study of geological maps with folded and faulted beds
4	Completion of outcrops - I
5	Completion of outcrops - II
6	Solving Structural problems from given structural data in vertical view
7	Solving Structural problems from given structural data in vertical view
8	Solving Structural problems from given structural data in planar view
9	Solving Structural problems from given structural data in planar view

GLY-361-Geology Practical -8
(Major- Practical)

10	Solving Structural problems from given structural data using stereographic projection
11	Solving Structural problems from given structural data using stereographic projection
12	Study of plant fossils associated with Gondwana Sequence of rocks.
13	Study of maps showing geographical distribution of the various Phanerozoic Stratigraphic units of India
14	Revision
15	Revision

	GLY-362-Geology Practical -9 Major Practical	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (COs) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Identify economic and industrial minerals in hand specimens and name major oceanic and atmospheric current systems	1
CO2	Infer the occurrence of petroleum deposits from given lithological data and economic deposits in India.	2
CO3	Classify different economic minerals according to their chemical composition	3
CO4	Compare petroliferous basins of India and industrial and ore minerals	4
CO5	Determine the use of different economically important deposits in industries.	5
CO6	Construct bathymetric profiles from given bathymetric charts, structural contours map, isopach maps and fence diagram for demarcation of petroliferous horizons	6

GLY-362 Geology Practical -9
(Major- Practical)

Expt. No.	Title of Experiment
1	Megascopic study of ore minerals - I
2	Megascopic study of ore minerals - I
3	Megascopic study of industrial minerals - I
4	Megascopic study of industrial minerals - II
5	Preparation of ore mineral maps of India for the following:Fe, Mn, Cr, Cu, Pb, Zn & Al.
6	Preparation of isotherms
7	Preparation of isobars
8	Analysis of rainfall data
9	Study of the oceanic conveyor belt with major current systems
10	Construction and study of (ocean) bathymetric profile
11	Study of structural contours and isopach maps
12	Construction of structural contours and isopach maps
13	Categorisation of petroliferous basins of India
14	Construction of Fence diagram for demarcation of petroliferous horizon.
15	Revision

	GLY-382-Geology Practical -10 **VSC**	
	Number of Credits:02 **Number of Hours:60**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Recall fundamental concepts associated with gravity, magnetism, electricity and wave motion	1
CO2	Summarize various geophysical properties of the earth related to gravity, magnetism, electricity and wave motion.	2
CO3	Apply geophysical concepts in prospecting of economically important deposits.	3
CO4	Analyse and calculate various geophysical properties of the earth using geophysical data.	4
CO5	Evaluate the geophysical character of rocks.	5
CO6	Compile and validate geophysical data using field observations	6

GLY-382-Geology Practical -10
VSC

Expt. No.	Title of Experiment
1	Calculations of gravity values of earth.
2	Analyze the gravity data to find out the 'g' and correlate it with the geology of the area.
3	Construct the gravity profile of the area from the given gravity data.
4	Calculate the various parameters associated with the earth's magnetic field.
5	Calculate the paleolattitudes and palaeolongitudes from the given rock magnetic data.
6	Calculate the velocities of plate movements from the past using palaeomagnetic data.
7	Interpret the Bouger anomaly maps.
8	Calculate the current/ voltage/resistance from the given data.
9	Calculate the resistivity of the rock formations in the area from the data generated from resistivity survey by various methods
10	Construct the resistivity profile of the area and correlate them in interpreting the subsurface geology of the area
11	Find the epicentre of the earthquakes from the given data.
12	Analyze the seismic reflection profiles to interpret the subsurface geology of the area.
13	Revision and assessment
14	Revision and assessment
15	Revision and assessment

Learning Resources- References

Sr. No.	References
1.	Ramchandra Rao (1975) Outlines of geophysical prospecting: a manual for geologists, University of Mysore.
2.	William Lowrie (1997) Fundamentals of Geophysics, Cambridge University Press
3.	Dobrin M. B. (1960) Introduction to Geophysical Prospecting, Mcgraw Hill.
4.	Philip Kerry, Michael Brooks, Ian Hill (2002) Introduction to Geophysical Exploaration, Wiley India

	GLY-371 Applied Geology **Minor** **Theory**	
	Number of Credits:02 **Number of Hours:30**	
Course Outcomes (Cos) **On completion of the course, the students will be able to:**		**Bloom's cognitive level**
CO1	Describe the concepts of engineering geology and outline the applications of geology in engineering projects	1
CO2	Discuss basic concepts related to fluid motion in porous media.	2
CO3	Illustrate the concept of aquifers and their boundaries and occurrence and movement of petroleum in rocks.	3
CO4	Explain the types of raw materials used in engineering projects.	4
CO5	Compare types of mines and mining methods	5
CO6	Prepare a report on resource management on basis of basic geological concepts	6

GLY-371-Applied Geology
(Minor-Theory)

Unit No.	Title of Unit and Contents	Number of Hours
I	**Introduction to Engineering Geology** Introduction to Engineering Geology, Applications of geology in engineering projects, Engineering properties of rocks, Study of different engineering structures **Petroleum Geology** Occurrence of petroleum, nature of source rock, Reservoir and Traps, Origin, migration and accumulation of petroleum, Petroliferous basins of India and the world	**15**
II	**Mining Geology** Mining methods and terminology associated with mining activities, Types of mines **Hydrogeology** Definition - Hydrology, Hydrogeology, Groundwater and the hydrologic cycle, Groundwater as a resource, Groundwater crises, Global groundwater scenario, Indian groundwater scenario and scope and groundwater development in India, Vertical distribution of groundwater, Origin of groundwater, Aquifers and their types	**15**

Learning Resources- References

Sr. No.	References
1.	Todd D. K. (2007) Groundwater Hydrology, Wiley.
2.	Engineering Geology, (2013): Parbin Singh, S. K. Kataria & Sons
3.	Deshpande, B. G. (2009) The world of Petroleum, New Age International, New Delhi
4.	Economic Geology: Economic Mineral Deposits Second Edition, Umeshwar Prasad, 2002

T. Y. B. Sc. Semester-VI		
	GLY-395 On Job Training (Theory/Practical)	
	Number of Credits:04 **Number of Hours:120**	