

BHARATHIAR UNIVERSITY
COIMBATORE -641 046

REGULATIONS AND SYLLABUS
(Effective from the Academic Year: 2019– 2020 onwards)

Bachelor of Science (B.Sc.,) – Geology degree course

TABLE I B.Sc., GEOLOGY COURSE OF STUDY AND SCHEME OF EXAMINATION

YEAR OF STUDY	SEMESTER	PART/PAPER No.	PAPER CODE	TITLE OF THE PAPER	CREDITS	INTERNAL MARKS (I.A.)	EXTERNAL MARKS (S.E.)	TOTAL MARKS
I B.Sc.,	I	<i>Part-I</i>		TAMIL PAPER-I	4	25	75	100
		<i>Part-II</i>		ENGLISH PAPER-I	4	25	75	100
		<i>Part-III</i> MAJOR PAPER-I		PHYSICAL GEOLOGY	4	25	75	100
		ALLIED PAPER-I		ALLIED CHEMISTRY PAPER-I	3	20	55	75
		MAJOR PRACTICAL-I		STRUCTURAL GEOLOGY AND SURVEYING	EXAMINATION AT END OF II SEMESTER			
		ALLIED PRACTICAL		ALLIED CHEMISTRY PRACTICAL				
		<i>Part-IV</i>		ENVIRONMENTAL STUDIES #	2		50	50
					17			425
	II	<i>Part-I</i>		TAMIL PAPER-II	4	25	75	100
		<i>Part-II</i>		ENGLISH PAPER-II	4	25	75	100
		<i>Part-III</i> MAJOR PAPER-II		GEOMORPHOLOGY AND STRUCTURAL GEOLOGY	4	25	75	100
		ALLIED PAPER-II		ALLIED CHEMISTRY PAPER-II	3	20	55	75
		MAJOR PRACTICAL-I		STRUCTURAL GEOLOGY AND SURVEYING	4	40	60	100
		ALLIED PRACTICAL		ALLIED CHEMISTRY PRACTICAL	2	20	30	50
<i>Part-IV</i>			VALUE EDUCATION - HUMAN RIGHTS 3	2		50	50	
				23			575	
II B.Sc.,	III	<i>Part-I</i>		TAMIL PAPER-III	4	25	75	100
		<i>Part-II</i>		ENGLISH PAPER-III	4	25	75	100
		<i>Part-III</i> MAJOR PAPER-III		PALAEONTOLOGY	4	25	75	100
		ALLIED PAPER I		ALLIED PHYSICS PAPER-I	3	20	55	75
		MAJOR PRACTICAL-II		PALAEONTOLOGY AND CRYSTALLOGRAPHY PRACTICAL	EXAMINATION AT END OF IV SEMESTER			
		ALLIED PRACTICAL		ALLIED PHYSICS PRACTICAL				
		<i>Part-IV</i>		SBE-I FIELD GEOLOGY	3	20	55	75

			Tamil @ / Advanced Tamil# (OR)Non-major elective – I (Yoga for Human Excellence)# / Women’s Rights #	2		50	50	
				20			500	
	IV	Part-I	TAMIL PAPER-IV	4	25	75	100	
		Part-II	ENGLISH PAPER-IV	4	25	75	100	
		Part-III MAJOR PAPER-IV	CRYSTALLOGRAPHY AND OPTICAL MINERALOGY	4	25	75	100	
		ALLIED II	ALLIED PHYSICS PAPER-II	3	20	55	75	
		MAJOR PRACTICAL –II	PALAEONTOLOGY AND CRYSTALLOGRAPHY PRACTICAL	4	40	60	100	
		ALLIED PRACTICAL	ALLIED PHYSICS PRACTICAL	2	20	30	50	
		Part-IV	SBE-II NATURAL DISASTER MANAGEMENT	3	20	55	75	
			Tamil @ /Advanced Tamil # (OR)Non-major elective – II (General Awareness #)	2		50	50	
		Part-V	EXTENSION ACTIVITIES	2	50		50	
				28			650	
III B.Sc.,	V	PART-III MAJOR PAPER-V	MINERALOGY	4	25	75	100	
		PART-III MAJOR PAPER-VI	STRATIGRAPHY AND INDIAN GEOLOGY	4	25	75	100	
		PART-III MAJOR PAPER-VII	IGNEOUS AND METAMORPHIC PETROLOGY	4	25	75	100	
		PART-III MBE PAPER-I	HYDROGEOLOGY	4	25	75	100	
		MAJOR PRACTICAL -III	MINERALOGY AND PETROLOGY			EXAMINATION AT END OF VI SEMESTER		
		Part-III	ELECTIVE I REMOTE SENSING	4	25	75	100	
		Part-IV	GEMMOLOGY	3	20	55	75	
					23			575
	Part-III MAJOR PAPER-VIII	SEDIMENTARY PETROLOGY AND ENVIRONMENTAL GEOLOGY	4	25	75	100		

	VI	Part-III MAJOR PAPER- IX		ECONOMIC GEOLOGY	4	25	75	100
		Part-III MAJOR PAPER-X		MINING GEOLOGY AND ORE DRESSING	4	25	75	100
		Part III Major based elective		EXPLORATION GEOLOGY AND MINERAL FUELS	4	25	75	100
		Part III Major based elective		ENGINEERING GEOLOGY,COMPUTER APPLICATIONS IN GEOLOGY AND GEOSTATISTICS	4	25	75	100
		MAJOR PRACTIC AL-III		MINERALOGY AND PETROLOGY PRACTICAL	4	40	60	100
		Skill based elective Practical		ECONOMIC MINERALS AND FIELD GEOLOGY PRACTICAL	3	20	55	75
					29			675
TOTAL				CREDITS	140			3450

No Continuous Internal Assessment (CIA).
Only University Examinations.
*% Theory – 10/40 Marks, Practical – 20/30 marks.

* For Viva: 20% marks & report: 80% marks.

@ No University Examinations. Only Continuous Internal Assessment (CIA).

BHARATHIAR UNIVERSITY
COIMBATORE 641 046
B.Sc., GEOLOGY
I YEAR – I SEMESTER

PAPER CODE:

CREDIT: 4

PAPER I-PHYSICAL GEOLOGY

Broad Objectives & Methodology: Geology is the study of the Earth as a whole. Physical Geology introduces different topics which define geology as a branch of Physical Geology. The teaching and learning methodology involves class lectures, practical and laboratory demonstrations.

Learning Outcomes: To familiarize students with the concepts of physical geology and also to learn about various processes operational in and on the earth

UNIT I

Introduction to Geology – Branches and applications of Geology.

Solar System: Definition – A brief outline of: Planets – Satellites – Comets – Asteroid belt and asteroids – Meteorites. Kepler's Laws of Planetary Motion – Bode's Law. Origin of the Solar System: Planetesimal Model – Tidal Model – Nebular and Gas Cloud Models.

Age of the Earth- Direct Methods: Introduction to radioactivity – Radioactive minerals - Radioactive decay and isotopes-Concept of half life - Parent and Daughter elements. Outline and application of: U - Pb method; K - Ar method; Rb - Sr method and C^{14} method. Relative dating methods: - Cross cutting relations - Unconformable surfaces - Changes in lithology - Superposition of beds. **Indirect Methods:** - Short outline of glacial and lacustrine varves - tree rings - ocean salinity.

Short account of Earth parameters: Size, shape, rotation, revolution – Milankovitch cycle - perigee and apogee positions.

UNIT II

Interior of the Earth: Internal structure of the Earth: Crust - Mantle - Core. Brief account of seismic boundaries and discontinuities - shadow zones.

Earthquakes: Definition of Earthquake – Seismic waves: types – basic properties - generation of seismic waves in the earth. Location of EQs: focus (hypocentre) - epicentre. Magnitude and intensity of EQs – A brief introduction to seismogram and seismograph. The causes of EQs. The prediction of EQs and remedial measures. A brief introduction of Seismic zones and Indian EQs. -

Tsunamis & Seiche Waves: Definition - Types - Generation - Remedial measures. A brief outline of Indian Tsunamis.

UNIT III

Continental Drift: Definition - Evidences - Mechanisms - Wegener's and Taylor's idea of

continental drift. - **Sea floor spreading:** Definition - mechanism - evidences.

Plate Tectonics: Concept of plate tectonics - Types of plates - Major and Minor plates - plate movement and their causes - plate boundaries: convergent, divergent, & transform. Brief account of features related to plate tectonics: Island Arcs - Folded Mountain chains - Subduction zones - Trenches - Rift and ramp valleys - Ring of Fire. A Short account of volcanic and earthquake belts as related to plate tectonics.

Unit IV

Volcanoes: Definition of volcano and lava – Types of volcanoes – Volcanic products – Causes of Volcanism – Styles of volcanic eruption – Types of volcanic eruption – Prediction of volcanic eruptions. Volcanic landforms: craters - lava flows – pillow lava – domes – columnar lava structures. Distribution of volcanoes - Examples of Indian volcanoes.

Atmosphere: Definition - vertical extent - layers - composition - temperature variation - generation of wind on earth's surface.

Mountains: Definition of Mountain – Types and classification of Mountains – Origin of Mountains – Distribution of mountains in Indian sub continent. **Isostasy:** Concept of Isostasy - Models of Isostasy: Airy's model - Pratt's model.

Unit V

Plateaus and plains : Definition - characteristics and types of plateaus and plains – Short account of Deccan Plateau. **Weathering:** Definition - processes: erosion - transport - deposition. Agents of weathering. Types of weathering: physical - chemical - biological. Factors affecting weathering. **Line of products of weathering:** sediments - soil - regolith.

Rivers: Definition – origin – types of streams – stages of rivers – deltas and alluvial fans.

Lakes: Definition – Types of Lakes – Formation of Lakes – **Line of lake deltas and deposits.**

REFERENCE BOOKS & TEXT BOOKS

1. **Holmes, A & P.L. Duff.** (1996). Principles of Physical Geology, 4th revised edition, ELBS, London
2. **Radhakrishnan, V.** (1996). General Geology, V.V.P. Publishers, Tuticorin.
3. **Mahapatra, G.P.** (1994). Physical Geology, CBS Publishers, New Delhi.
4. **Mahapatra, G.P.** (1992). Textbook of Geology, CBS Publishers, New Delhi.
5. **Emiliani, C.** (1992). Planet Earth, Cambridge University Press, Delhi.
6. **Porter, S.C. & B.J. Skinner J.** (1995). The Dynamic Earth, John Wiley & Sons, New York.
7. **Leet, D & Judson, S** (1987). Physical Geology, McGraw Hill. New Jersey.
8. **Zumberge, J.** (1980). Physical Geology, Freeman, New York.
9. **Patwardhan, A.M.** (1999). Dynamic Earth System, Prentice Hall, New Delhi.
10. **Dasgupta, A.B.** (1978). Physical Geography, CBS Publishers, Delhi.

11. **Mukherjee, A.K.** (1990). Principles of Geology, EW Press, Kolkata.

12. **Reed, J.S. & T.H. Wicander.** (2005). Essentials of Geology, McGraw Hill., New York.

13. **Skinner, B.J., Porter, S.C., Park, J.J. and Levin, H.L., 2004.** Dynamic Earth: An introduction to physical geology.

14. **Earth Materials 2010 by Kevin Hefferan and John O' Brien**

Additional Resources: Physical Geology related materials are available in CD/DVD format in the Department.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks: Field excursion is suggested under proper supervision and with the submission of a field report.

**B.Sc.,, GEOLOGY,
I YEAR – II SEMESTER**

PAPER CODE:

CREDIT:

PAPER II - GEOMORPHOLOGY AND STRUCTURAL GEOLOGY

Broad Objectives & Methodology: Geomorphology is the study of different landforms and their evolution on the earth's surface. Structural Geology is the study of different structures in crustal rocks derived from different forces active on and within the earth's crust. The teaching and learning methodology involves class lectures, practical and laboratory demonstrations with equipment available in the Department. **Learning Outcomes:** The student gains useful insight and understanding of the earth's surface and the structures it contains through geomorphology and structural geology.

GEOMORPHOLOGY

UNIT I

Concept of Geomorphology: Geomorphic cycles. A brief account of first order, second order, and third order landforms. **Land forms created by Wind:** Erosion and deflation: features produced by erosion and deflation. Abrasion – features produced by abrasion. Attrition: features produced by attrition. Transportation: suspension, saltation, and surface. Deposition: loess, sand deposits. Sand dunes and their types.

UNIT II

Land Forms Created By Rivers: Erosion processes, erosional features: Potholes, Waterfalls, River

valleys, Gorges, Canyons, Escarpments, Hogback, Cuesta, Mesa, Butte, Peneplain, Pediments, River terraces, Badlands. Transportation – Deposition: Depositional features: Alluvial fans, and cones, Flood plains, Meanders, Ox – bow lakes, Braided rivers, and Delta. Cycle of erosion, River patterns, Drainage patterns. Outline of Rivers of India with special reference to Tamil Nadu. **Land Forms derived from Underground Water:** Definition of groundwater. Groundwater zones. Factors controlling groundwater movement. Sources of groundwater. Erosional features of groundwater: dolines, sink, caverns, solution valley, stylolite, depositional features: stalactites, stalagmites, siliceous sinter and travertine, geode, and concretionary structures.

UNIT III

Land Forms Created By Glaciers: Definition of glaciers, formation of glaciers, movement of glaciers. Types: valley glaciers, piedmont glaciers, continental glaciers, Surface features of glaciers. Glacial action: Erosion: plucking, rasping, avalanche, erosional features produced by valley glaciers: cirque, horn, glacial trough, hanging valleys, truncated spurs, glacial boulders, glacial scars, roches moutonnees, fjords. Depositional Features produced by continental ice sheets: crescentic gorges; drumlins. **Land Forms Created by Ocean:** Shore profile and shoreline development: continental shelf, continental slope, continental rise; Ocean floor-Marine erosion, Features formed by marine reefs – deep sea deposits, abyssal deposits, polygenic sediments, volcanogenic sediments, outline of mid oceanic ridges and submarine canyons. Outline of Geomorphology of Tamil Nadu.

STRUCTURAL GEOLOGY

UNIT IV

Introduction and scope of Structural Geology. Cardinal directions of a compass – whole circle and quadrant. Magnetic and true North. **Rock outcrops:** definition, types: sedimentary, igneous and metamorphic. **Orientation of rock outcrops:** strike – trend. **Tilt of rock outcrops:** Dip, apparent dip and plunge. **Sedimentary beds:** definition and types. Surficial structures of sedimentary beds: ripple marks, mud cracks, and rain imprints. Trends of outcrops – Contours - Topographic and Geological maps. **Concordant bodies:** Sills – Laccoliths – Lopoliths and Phacoliths. **Discordant bodies:** Dykes – Volcanic vents – Batholiths and stocks. Lava flows - Pillow lava structure.

UNIT V

Rock Joints: Definition – types – classification – outline of genesis. **Foliation and Lineation:** Definition of foliation and lineation - Brief account of common types of foliations and lineations. **Faults:** Definition and parts of a fault. Types – Geometric and genetic classification of faults – Horst and Graben – Criteria for recognition of faults in the field. **Folds:** Definition and parts of a fold - Geometry of folds – Classification – Plunging of folds – Anticlinorium - Synclinorium – outliers and inliers - recognition of folds in the field and on the map. **Unconformity:** Types and

geological significance of unconformities – Recognition of unconformities in the field and on a map.

REFERENCE AND TEXTBOOKS:

1. Worcester, P.G. (1960), A Text Book of Geomorphology, East West Press Ltd. Delhi.
2. Radhakrishnan, V. (1996), General Geology, V.V.P. Publications, Tuticorin.
3. Mahapatra, G.B. (1994), Text book of Physical Geology, CBS publications, Delhi.
4. Singh, S. (2007) Geomorphology. S. Chand & Co. Delhi.
5. Bloom, A. (1985), Principles of Geomorphology, Prentice Hall of India, Delhi.
6. Billings, M.P. (1974) Structural Geology. Prentice Hall of India Ltd. New Delhi.
7. Sathya Narayanaswami, B.S. (1994). Structural Geology. Dhanpat Rai & Sons. New Delhi.
8. Gokhale, N.W. (1995), Theory of Structural Geology, CBS, Delhi.
9. Davis, G.H. (1985). Structural Geology of Rocks and Regions. Elements of Structural geology, Wiley.
10. Hills, E.S. (1963). Elements of Structural Geology, Chapman & Hall. London.
11. Ragan, D.M., (2000). Structural Geology-An Introduction to Geometrical Techniques. Wiley. New York.
12. Park, P.G. (1983). Foundations of Structural Geology, Blackie. London.
13. Robert. J. Twiss and Eldridge. M. Moores (2007). Structural Geology, W.H. Freeman and Company, 695p

Additional Resources: The student may consult the Class Teacher for additional web resources and related materials. Other related materials are available in CD/DVD format in the Department. **Assignments:** Any two assignments may be suggested by the Teacher.

Suggested Group Work/Tasks: Field visit to known areas is suggested under proper supervision and with the submission of a field report.

B.Sc., GEOLOGY
I YEAR – II SEMESTER

PAPER CODE:

CREDIT:

PRACTICAL I - STRUCTURAL GEOLOGY AND SURVEYING

Practical Examination Maximum Marks:50

Records:10

Internal Assessment Maximum Marks:40

Broad Objectives & Learning Outcomes

The student is introduced to the basic knowledge relevant to geological maps. Map drawing exercises emphasize the use of completed geological maps to decipher the underlying structure and different methods of solving them. Practical exercises emphasize the use of compasses: Clinometer and Brunton. Survey Practical introduces the student to basic surveying which is relevant to geological mapping and mining geology.

SYLLABUS

Geological Maps:

Study of Topographical maps: Identification of land forms, structures such as fold, fault, unconformities and intrusions.

Field Uses of Clinometer and Brunton Compass.

Laboratory exercises in structural Geology maps: Contours – Completion of outcrops.

Three point problems, Fold Maps. Fault Maps, Unconformity maps. Complex maps with two structures such as fold and fault, fault and unconformity, etc.

Preparation of cross sections across the geological maps to bring out the structure of the area, interpretation of structures, determining the order of superposition of beds and writing the geological history of the area.

Exercise on structural geology problems: Graphical Determination of Dip in gradient. Determination of true dip by simple calculation. Determination of thickness of a bed by calculation on a level ground.

Surveying:

Chain surveying: Open traverse, closed traverse.

Prismatic Compass surveying: Determination of the distance between two inaccessible stations. Radiation method and Intersection method.

GPS surveying: Determination of the distance between two inaccessible stations. Radiation method and Intersection method.

Area calculation by applying polygone method by applying Arc GIS

FIELD TRAINING PROGRAMME:

I Year of the course.

In part fulfilment of B.Sc., Applied Geology Degree course, students should be taken on local field trips to study the geomorphology and structural geology of the area in and around Salem district, for a period of 3 to 4 days. The student should submit a report on the field training along with specimens collected from the field. Internal assessment marks for the practical are,

Practical Class Attendance = 5 marks; Practical Test= 10 marks; Field Training Report=25 marks; Total=40 Marks.

B.Sc., GEOLOGY
II YEAR - III SEMESTER
PAPER III - PALAEOLOGY

PAPER CODE: CREDITS: 4

Broad Objectives & Methodology: Palaeontology is the study of entombed animal and plant remains in rocks. Class lectures and practical, involving the study of representative fossils.

Learning Outcomes: The student gains insight into both subjects by combining theory with practical observation.

PALAEOLOGY

Unit I

Outline of Geological time scale. Definition of Fossils. Modes of preservation of fossils. Uses of fossils. Morphology and geological history of **Foraminifera**. Outline of uses of microfossils. **Phylum Porifera** – Sponges. **Phylum Brachiopoda**: Morphological characters – classification – geological and stratigraphical importance.

Unit II

Phylum Mollusca: Pelecypods - morphological characters – classification – geological and stratigraphical importance. **Gastropods** - morphological characters – classification – geological and stratigraphical importance. **Cephalopods** - morphological characters – classification – geological and stratigraphical importance..

Unit III

Phylum Hemichordata: Morphological characters – classification – geological and stratigraphical importance **Phylum Coelenterata:** Class Anthozoa - Corals: Morphological characters – classification – geological and stratigraphical importance.

Unit IV

Phylum Echinodermata: Morphological characters – classification – geological and stratigraphical importance. Morphological characters, geological and stratigraphical importance of Blastoids and Crinoids. **Phylum Arthropoda:** Morphological characters – classification – geological and stratigraphical importance.

Unit- V

Vertebrate Palaeontology: A short account on the classification of vertebrates. Outline of evolution of vertebrates through geological time. Introduction to Dinosaurs. Short account of Indian dinosaurs: Kotasaurus, Rajasaurus, Stegosaurus, and Ankylosaurus. A brief account of Archaeopteryx and Pterosaurs. **Palaeobotany:** Classification of plant fossils – modes of

preservation of plant fossils. Short account of Gondwana flora; Glossopteris, Gangamopteris, Calamites, Lepidodendron, Sigillaria and Ptilophyllum.

REFERENCE & TEXT BOOKS:

Palaeontology

1. **Black, R.M.** (1972). Elements of Palaeontology. Oxford University Press. Oxford. UK.
2. **Clarkson, E.N.K.** (2005). Invertebrate Palaeontology and Evolution. Wiley. New Delhi.
3. **Easton, W.H.** (1960). Invertebrate Palaeontology. Harper & Brothers. New York.
4. **Moore, R.C. et al.** (1952). Invertebrate Fossils. CBS. Delhi.
5. **Agashe, S.N.** (1995). Palaeobotany. Oxford & IBH. Delhi.
6. **Jain, M.L. & P.C. Anantharaman.** (2017). An Introduction to Palaeontology. Vishal Publications. Delhi.
7. **Sahni, A.** (2001). Dinosaurs of India. NBT. Delhi.
8. **Stewart, W.N. & G.W. Rothwell.** (2005). Palaeobotany. Cambridge University Press. Delhi.
9. **Benton, M.J.** (1995). Vertebrate Palaeontology. Wiley. New Delhi.
10. **Colbert, E.H. et al.** (2002). Evolution of the Vertebrates. Wiley. New Delhi.
11. **Richard, C.** (2000). History of Life. Wiley. New Delhi.

Additional Resources: Palaeontology and Crystallography related materials is available in CD/DVD format in the Department.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks: Field collection of fossils and crystalline minerals of a known area under proper supervision and submission of a field report.

B.Sc., GEOLOGY
II YEAR - III SEMESTER - PART – IV SKILL BASED ELECTIVE PAPER – I
SBE I- FIELD GEOLOGY

PAPER CODE:

CREDIT

Broad Objectives & Methodology: To introduce the student to: the significance of field training in geology, explain and demonstrate the different field techniques, enable the student to prepare a field plan and execute mapping of an area, and to prepare a geological report based on the geological mapping and related field work. Class lectures and practical, field demonstrations emphasizing: proper method of instruments handling and safety, use of field note book and information on personal safety and camping. **Learning Outcomes:** The student gains insight into the methods of geological mapping and can gain expertise by proper practice. This expertise may be useful in the particular field of geology the student wishes to pursue for employment.

Unit I

Definition and scope of Field Geology – Prior planning – Basic equipment required for field work – Types of field investigations. Field work objectives and types of data collected. Introduction to topographic maps: parts, symbols, and other information. Basic concepts: relief, contours, slope, gradients, profiles and sections. Interpretation of topographic maps. Base map preparation and map scale.

Unit II

Rock outcrops and their surficial expressions. Basic concepts: strike, dip, apparent dip and rock trends. Introduction to the outcrop features used in mapping: foliations, lineations, bedding, and lithological contacts. Geological mapping: Techniques of mapping: Traverse methods: Compass and Contact traverse, Exposure mapping, Variable lithology mapping, Line maps. Preparation of field note based data sheet.

Unit III

Field Equipments

Clinometer compass: different parts and their functions. Measuring attitude of linear structures – determination of bearings – advantages and limitations. Brunton Compass: different parts and their functions - measuring attitude and trends – determination of bearings – adjustments –

magnetic declination in topographic sheets - advantages and limitations. Brief account on the utility of Prismatic Compass and Plane Table in mapping open cast mines and quarries.

Unit IV

Brief account of the following: Use of Aerial Photographs in geological mapping – Structural mapping – Stratigraphic mapping methods. outline of mapping methodology for – igneous terrain, sedimentary terrain and metamorphic terrain. Methods of mapping in areas with sparse outcrops. Outcrop structural features common to all rock types. outline of use and applications of GPS in field geology. Sample location techniques in digital base maps.

Unit V

Field geological report: parts and preparation. Geological and topographic map symbols. Brief introduction of field indicators used in geological mapping: geomorphological, weathering, mineral composition and petrography. Geological materials: types of samples – mineral, ore, fossil, rock. Methods of sampling -care and packing of samples in the field. outline of preparation of thin sections of geological samples.

REFERENCE AND TEXTBOOKS

1. **Compton, R.R.** (1985). *Geology in the Field*, John Wiley & Sons Inc., New Delhi.
2. **McClay, K.R.** (2003) *The Mapping of Geological Structures*, 2nd ed., John Wiley & Sons Ltd, New Delhi.
3. **Compton, R.R.** (1966). *Manual of Field Geology*. 2nd ed., New York, Wiley.
4. **Lahee, F** (1987). *Field Geology*, CBS Publishers, New Delhi.
5. **Mathur, S.M.** (2001). *Guide to Field Geology*. Prentice Hall India. New Delhi.
6. **Gokhale, N.W.** (2001). *A Guide to Field Geology*. CBS Publishers, New Delhi.
7. **Coe, A.L.** (ed). (2010). *Geological Field Techniques*. Open University Press, Milton Keynes, UK.
8. **Barnes, J.W.** (2004). *Basic Geological Mapping*. John Wiley & Sons Inc., New Delhi.
9. **Freeman, T.** (1999). *Procedures in Field Geology*. John Wiley & Sons Inc., New Delhi.

Additional Resources

Field Geology related animations available in CD/DVD format in the Department.

Assignments

Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks

Field Mapping of a known area under proper supervision and submission of a field report.

B.Sc., GEOLOGY
II YEAR - IV SEMESTER
PAPER IV – CRYSTALLOGRAPHY AND OPTICAL MINERALOGY

PAPER CODE: CREDITS: 4

Broad Objectives & Methodology: Palaeontology is the study of animal and plant remains in rocks. Crystallography is the foundation of mineralogy, inorganic chemistry and material science. Optical mineralogy is the method of studying and observing features of minerals in thin sections for identification. Class lectures and practical, involving the study of representative fossils, crystal models and mineral thin sections. **Learning Outcomes:** The student gains insight into the subjects by combining theory with practical observation.

UNIT-IV:

CRYSTALLOGRAPHY

Definition of crystal. Morphological characters of crystals: Faces-Forms-Edges-Solid angles-Interface angles. Contact Goniometer and its uses. Symmetry elements in crystals. Crystallographic axes and axial ratio – Parameters - Indices and symbols: Miller system of notation. Laws of Crystallography: Law of constancy of interfacial angles. Law of Rational Indices. Classification of crystal systems. Study of : holohedral, hemihedral, hemimorphic and enantiomorphous forms of crystals.

UNIT-V:

Cubic System: Symmetry elements - forms and representative mineral of the normal, pyritohedral, tetrahedral and plagiohedral classes. **Tetragonal system:** Symmetry element and forms of normal, hemimorphic, tripyramidal, pyramidal hemimorphic, sphenoidal and trapezohedral classes.

Unit II:

Hexagonal system: Symmetry elements and forms. **A. Hexagonal division:** normal, hemimorphic, tripyramidal, and trapezohedral classes with type minerals. **B. Rhombohedral division:** rhombohedral, rhombohedral-hemimorphic, trirhombohedral, and trapezohedral classes. **Orthorhombic system:** study of the symmetry element and forms of the normal, hemimorphic, and sphenoidal classes with type minerals.

Unit III

Monoclinic system: study of the symmetry elements and forms of the normal class.

Triclinic system: Study of the symmetry elements and forms of the normal class. **Twin crystals:** Definition –evidence of twinning-laws of twinning-compositional plane, twinning plane and twin axis-twins: simple, repeated (polysynthetic twin), contact, and penetration twin.

OPTICAL MINERALOGY

UNIT-IV:

Light: Corpuscular, electromagnetic and quantum theories. Ordinary light and plane polarized light. Refractive index and its determination: Relief method, Becke line, Central illumination, and Oblique illumination methods. Isotropism, isotropic minerals and isotropic ray velocity surface. Behaviour of light in isotropic minerals. Petrological Microscope and its parts-optical accessories and their uses: Quartz wedge, Gypsum plate and Mica plate. Study of Isotropic minerals using the petrological microscope: properties of isotropic minerals under parallel Nicol conditions.

UNIT-V:

Anisotropism and anisotropic minerals. Behaviour of ordinary light in uniaxial minerals: Double refraction - Indicatrix - Optic axes – Optic sign. Nicol prism and its construction. Behaviour of polarized light in uniaxial minerals. Pleochroism, retardation, birefringence, extinction, and interference colours in uniaxial minerals. Study of Uniaxial minerals using the petrological microscope: under parallel (PN) and crossed Nicol (XN) conditions. Uniaxial interference figure.

Behaviour of ordinary light in biaxial minerals. Behaviour of polarized light in biaxial minerals. Study of Biaxial minerals using the petrological microscope: under PN and XN conditions. Biaxial Indicatrix - optic axes and optical axial angles – biaxial extinction and extinction angles –Trichroism. Biaxial interference figure. Michel Levi interference colour chart and orders of interference colour.

REFERENCE & TEXT BOOKS:

Crystallography & Optical Mineralogy

1. **Ford, W.E.** (1988). Dana's Textbook of Mineralogy. Wiley. New Delhi. (Reprint).
2. **Hota, R.N.** (2011). Practical Approach to Crystallography and Mineralogy. CBS. New Delhi.
3. **Sengupta, S.** (1980). Crystallography and Optical Mineralogy. EW Press. Delhi.
4. **Phillips, F.C.** (1965). Crystallography. ELBS. London
5. **Bishop, A.C.** (1967). An Outline of Crystal Morphology. Hutchinson. London.
6. **Kerr, P.F.** (1977). Optical Mineralogy, 4th ed. McGraw Hill New York.
7. **Gribble, C.D. & A.J. Hall.** (1985). A Practical Introduction to Optical Mineralogy. Springer. London.
8. **MacKenzie, W.S. & C. Guilford.** (1993) Atlas of Rock-Forming Minerals in Thin

Section, Longman, UK.

9.Perkins,D.& K.R.Henke. (2003). Minerals in Thin Section, Prentice Hall, New Delhi.

10.Raith,P.M. (2011). Optical Mineralogy. MSA. Virginia. USA. (e-book)

Additional Resources: Paleontology and Crystallography related materials is available in CD/DVD format in the Department.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks: Field work involving collection of fossils and crystalline minerals of known areas under proper supervision and submission of a field report. Preparation of a thin section of a mineral under proper supervision.

B.Sc., GEOLOGY

II Year - IV Semester

PRACTICAL II - PALAEOLOGY AND CRYSTALLOGRAPHY

PAPER CODE: CREDITS: 3

Practical Examination Maximum Marks: 60

Practical Examination Marks :50

Records :10

Marks for Internal Assessment :40

PALAEOLOGY:

Identification of fossils on the basis of morphological characters. Fixing the biological position and range in time of the following classes of fossils:

Foraminifera : Textularia, Quinqueloculina, Globigerina, Lagena, Nummulites. **Porifera :** Siphonia and Ventriculites. **Pelecypods:** Meretrix, Arca, Cardium, Cardita, Pecten, Venus, Unio, Pinna, Modiola, Lima, Inoceramus, Alectryonia, Gryphaea, Exogyra, Spondylus, Pectenculus, Radiolites, Trigonina, Ostrea. **Gastropods:** Turritella, Cerithium, Turbo, Trochus, Natica, Conus, Fusus, Physa, Busycon, Voluta, Murex, Bellerophon, Helix, Cyprea, Euomphalus. **Cephalopods:** Orthoceras, Nautilus, Goniatites, Ceratites, Acanthoceras, Schloenbachia, Scaphites, Perisphinctes, Turritites, Baculites, Belemnites. **Brachiopods:** Lingula, Spirifer, Productus, Terebratula, Rhynchonella, Pentamerus, Atrypa, Athyris. **Corals:** Calceola, Zaphrentis, Thecosmilia, Cyclolites, Favosites, Omphyma,

Halysites, Lithostrotion. **Echinoids:** Echinus, Cidaris, Hemicidaris, Micraster, Holaster, Hemiaster, Stigmatophygus. **Crinoidea:** Echinus Apiocrinus, Pentacrinus. **Blastoidea:** Pentremites.

Trilobites: Paradoxides, Calymene, Olenellus, Olenus, Asaphus, Trinucleus, Phacops. **Graptolites:** Monograptus, Rastrites, Diplograptus, Phyllograptus, Tetragraptus. **Plant fossils:** Glossopteris, Gangamoptris, Ptilophyllum, Lepidodendron, Sigillaria, Stigmaria, Calamites.

CRYSTALLOGRAPHY:

Measurements of interfacial angle by using contact goniometer. Stereographic projection exhibiting symmetry elements of normal classes of the six crystal systems. Study of Crystal

Models: Determination of system and class on the basis of symmetry elements. Description of forms present and determination of Miller indices of the following crystal models. **Cubic System:** Galena, Garnet, Fluorite, Magnetite, Pyrite, Tetrahedrite, Boracite. **Tetragonal System:** Zircon, Apophyllite, Rutile, Vesuvianite, Cassiterite, Octahedrite, Scheelite, Meionite, Chalcopyrite. **Hexagonal System:** Beryl, Zincite, Apatite, Hematite, Calcite, Corundum, Tourmaline, Phenacite, Alpha Quartz. **Orthorhombic System:** Barite, Olivine, Sulphur, Topaz, Staurolite, Calamine, Epsomite.

Monoclinic System: Gypsum, Augite, Orthoclase, Epidote, Hornblende. **Triclinic System:** Axinite, Albite, Anorthite, Kyanite, Rhodonite. **Study of Twin Crystal Models of the following**

Crystal Systems: **Cubic:** Spinel, Iron Cross twin. **Tetragonal:** Rutile, Zircon, Cassiterite.

Hexagonal: Brazil law – Calcite, Quartz. **Orthorhombic:** Cruciform, Aragonite – Staurolite. **Monoclinic:** Mica, Orthoclase: Carlsbad, Manebach and Baveno type, Gypsum.

Triclinic: Albite – Simple Twin.

FIELD TRAINING PROGRAMME: II Year of the Course.

In part fulfillment of the B.Sc., Applied Geology degree course, the students should be taken to areas with outcrops of fossil bearing rocks for a period of 5 to 7 days, to collect and study modes of preservation of fossils. They should present the collected fossils and submit a report on the field training at the time of the Main Practical Examination.

Internal Assessment Marks for the practical are given below:

Attendance in Practical Classes: 5 marks; **Practical Tests:** 10 marks. **Full Attendance during field training, collection, and submission of field report:** 25 marks. **Total: 40 marks.**

B.Sc., GEOLOGY
II YEAR - IV SEMESTER
PART- IV -SKILL BASED ELECTIVE PAPER – 2 - SBE II - NATURAL DISASTER
MANAGEMENT

PAPER CODCREDIT 2

Broad Objectives & Methodology: The student is introduced to the dangers, problems, effects of natural disasters and their mitigation measures. The methodology of teaching involves class lectures with discussion of case studies relevant to India. **Learning Outcomes:** The student gains insight and an informed awareness of natural disasters for future safety measures and preparedness.

Unit-I

An introduction to Natural disasters: floods- cyclones – earthquakes – volcanoes – landslides-tsunamis. Monsoons: North East and South West monsoon – cyclones and storms – surface water flows and river flows. Flooding – flood control measures: check dams. Precautionary measures: warning systems and cyclonic shelters. Failure of monsoons and droughts. Remedial measures and preparedness.

Unit-II

Earthquake: Definition – Type of shock waves: Body waves: P waves, S waves. Surface waves: P waves, L waves – Causes of earth quakes. Destructions due to earthquake – Richter scale – Major earthquakes in India. Prediction of Earthquakes and warning systems. Earthquake monitoring and disaster management measures.

Unit-III

Volcanoes: type of volcanoes – causes of volcanoes – products of volcanoes. Destruction due to volcanic eruptions. Major volcanic eruptions in India. Submarine volcanoes. Prediction of volcanic eruptions and early warning systems. Active volcano monitoring and disaster management measures.

Unit-IV

Landslides: definition – terminology – classification. Causes of landslides: slope changes – tectonic activity – rock structures – role of water in landslides – effects of Human activity. Destruction due to landslides – precautionary measures. Glaciers and its avalanches. Major landslides in India. Landslides warning systems and early detection. Landslide disaster management measures.

Unit-V

Tsunamis: definition – causes of tsunami: submarine earthquakes and tsunamis – Impact of tsunamis – Major Tsunamis. Advance warning systems for Tsunamis – Tsunamis disaster management measures – seiche waves in lakes.

REFERENCES AND TEXTBOOKS

1. **Holmes,A & P.L.Duff.** (1996). Principles of Physical Geology, 4th revised Edition,ELBS,London
2. **Radhakrishnan,V.** (1996). General Geology, V.V.P. Publishers,Tuticorin.
3. **Mahapatra,G.P.** (1994). Physical Geology,CBS Publishers,New Delhi.
4. **Mahapatra,G.P.** (1992). Textbook of Geology, CBS Publishers,New Delhi.
5. **Emiliani,C.**(1992). Planet Earth, Cambridge University Press, Delhi.
6. **Porter,S.C. & B.J. SkinnerJ.** (1995). The Dynamic Earth, John Wiley & Sons, New York.
7. **Leet,D & Judson,S** (1987). Physical Geology, McGraw Hill. New Jersey.
8. **Zumberge,J.**(1980). Physical Geology, Freeman, New York.
9. **Patwardhan,A.M.** (1999). Dynamic Earth System, Prentice Hall, New Delhi.
10. **Mukherjee,A.K.** (1990). Principles of Geology,EW Press,Kolkata.
12. **Reed,J.S. & T.H. Wicander.** (2005). Essentials of Geology, McGraw Hill., New York.
17. **Miller,T.G.** (2004). Environmental Science. Wadsworth Publishing. USA.

Additional Resources:Natural disaster management related materials are available in CD/DVD format in the Department.**Assignments:** Any two assignments (within the five units) may be suggested by the Teacher.

B.Sc., GEOLOGY
III YEAR – V SEMESTER
PAPER V - MINERALOGY

PAPER CODE- CREDIT

Broad Objectives & Methodology: Mineralogy is the foundation for petrology and field geology. The student is introduced to the different mineral groups emphasizing their properties for megascopic and thin section identification and their distribution in different earth materials. The teaching and learning methodology involves class lectures and practical, field identification demonstrations, and microscopic techniques. **Learning Outcomes:** The student gains useful insight into the methods of mineral identification. This expertise may be used in field geology and laboratory studies of minerals.

UNIT-I:

Definition of a mineral. Properties based on external appearance:- Form – Habit and state of aggregation - Colour – Lustre – Diaphaneity. Properties based on crystal structure : Hardness and Tenacity – Cleavage – Fracture – Parting. Properties based on taste – odour – tactile feeling. Specific gravity of minerals. Thermal, magnetic, and electrical properties of minerals. Radioactivity in minerals.

UNIT-II:

Physical, chemical, optical properties, association, mode of occurrences and uses of the following mineral groups: Quartz Group - Feldspar Group – Feldspathoids Group. Short note on twinning in feldspars.

UNIT-III:

Physical, chemical, optical properties, association, mode of occurrences and uses of the following mineral groups: Pyroxene Group – Amphibole Group – Chlorite Group.

UNIT-IV:

Physical, chemical, optical properties, association, mode of occurrences and uses of the following mineral groups: Mica Group – Garnet Group – Zeolite Group.

UNIT-V:

Physical, chemical, optical properties, association, mode of occurrences and uses of the following mineral groups: Olivine Group – Epidote Group - Spinel Group. Descriptive study of the following minerals: Andalusite, kyanite, sillimanite, scapolite, apatite, tourmaline, cordierite, sphene, beryl, rutile, and fluorite.

REFERENCE & TEXT BOOKS:

1. **Gribble, C.D.** (1988). R17ey's Elements of Mineralogy. CBS, New Delhi.
2. **Deer, W.A., R.A. Howie & J. Zussman** (1992). An Introduction to the Rock-Forming Minerals. ELBS. London.
3. **Blackburn, W.H. & W.H. Dennen.** (1994). Principles of Mineralogy, 2nd ed. William C. Brown, Dubuque, IA.
4. **Klein, C. & C.S. Hurlbut, Jr.** (1993) Manual of Mineralogy, 21st ed. John Wiley and Sons, New York.
5. **Wenk, H.R & A. Bulakh.** (2006). Minerals. Cambridge University Press, New Delhi.
6. **Perkins, D.** (2010). Mineralogy, 3rd ed. Prentice Hall India, New Delhi.
7. **Bathey, M.** (1978). Mineralogy for Students, Oxford University Press, UK.
8. **Berry, L.G., B. Mason & R.V. Dietrich.** (1985). Mineralogy, CBS New Delhi.
9. **Hota, R.N.** (2011). Practical Approach to Crystallography and Mineralogy, CBS, New Delhi.
10. **Haldar, S.K. & J. Tisjlar.** (2014). Introduction to Mineralogy and Petrology, Elsevier, Netherlands.
11. **Kerr, P.F.** (1977). Optical Mineralogy, 4th ed. McGraw Hill New York.
12. **MacKenzie, W.S. & C. Guilford.** (1993) Atlas of Rock-Forming Minerals in Thin Section, Longman, UK.
17. **Heinrich, E.W.** (1965). Microscopic Identification of Minerals. McGraw-Hill. New York.
14. **Gribble, C.D. & A.J. Hall.** (1985). A Practical Introduction to Optical Mineralogy. Springer. London.
15. **Perkins, D. & K.R. Henke.** (2003). Minerals in Thin Section, Prentice Hall, New Delhi.

Additional Resources: Mineralogy related materials are available in CD/DVD format in the Department on written request.

Web resources: Mineralogical Society of America: <http://www.minsocam.org>

Mineralogy Databases: <http://webmineral.com>. <http://www.mindat.org>.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks: Field excursion to a known area under proper supervision and submission of a field report.

B.Sc., GEOLOGY
III YEAR - V SEMESTER
PAPER VI-STRATIGRAPHY AND INDIAN GEOLOGY

PAPER CODE:

CREDITS:

Broad Objectives & Methodology: The student is introduced to the basic principles of Stratigraphy and Indian Geology. The methodology of teaching involves class lectures with relevant multimedia materials: digital charts, rocks, and others.

Learning Outcomes: The student gains insight into the principles of Stratigraphy and Indian Geology. This knowledge is useful for field geology, mineral exploration, oil exploration, and tectonics.

STRATIGRAPHY

UNIT-I:

Definition and scope of Stratigraphy. Principles and laws of Stratigraphy. Methods of Stratigraphic Correlation. Concept of homotaxial and contemporaneous formations. Stratigraphic Nomenclature: Lithostratigraphy – Biostratigraphy – Chronostratigraphy, Geological Time Scale and Standard Geological divisions. Imperfections in the Geological record.

INDIAN GEOLOGY

UNIT-II:

Physiographic divisions of India. Structure and Tectonic divisions of India: Peninsular India, Extra-Peninsular India and Indo-Gangetic alluvial plains. -Study of Archaean Group: Dharwar system of Karnataka - mineral riches.

UNIT-III:

Study of the following geological formations of India: Proterozoic Group: Cuddapah System; Delhi System; Vindhyan System; Kurnool System. Paleozoic Group: Paleozoic of Spiti; Permo – Carboniferous of Salt Range.

UNIT-IV:

Study of the following geological formations of India: Gondwana Group: Classification – lithology – deposits – fossil content – climate - economic importance. Triassic of Spiti; Jurassic of Kutch; Cretaceous of Trichinopoly and Narmada valley.

UNIT-V:

Study of the following geological formations of India: Deccan Traps: distribution – structure - Lameta beds – Inter-trappean and Infra-trappean beds - Bagh beds; Tertiary Group : Eocene of Assam, Cuddalore sandstone of Tamil Nadu and Quilon beds of Kerala; Siwalik System; outline of Pleistocene Ice Ages in India. Karewa formation; Recent: Placer deposits of Tamil Nadu.

Rise of Himalayas.

REFERENCE & TEXTBOOKS:

1. **Krishnan, M.S.** (1986). Geology of India, Burma and Pakistan. CBS. New Delhi.
2. **Wadia, D.N.** (1953). Geology of India. McMillan India. Delhi.
3. **Kumar, R.** (1988). Fundamentals of Historical Geology and Stratigraphy of India, Wiley. New Delhi.
4. **Weller, J.M.** (1960). Stratigraphic Principles and Practice. University Book Stall. New Delhi.
5. **Mehdiratta, R.C.** (1974). Geology of India, Pakistan, Bangladesh and Burma. Atma Ram & Sons. Delhi.
6. **Vaidyanadhan, R & M. Ramakrishnan.** (2008). Geology of India. Geological Society of India. Bangalore.
7. **GSI.** (2005). Geology & Mineral Resources of the States of India. Misc Pub. No.30. Geological Survey of India. Kolkata. (Several individual volumes available online at GSI portal).

Additional Resources: Web resources related to Stratigraphy and Indian Geology related materials are available in the Department.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks

Field visits to Stratigraphically significant areas within Tamil Nadu under proper supervision is suggested.

B.Sc., GEOLOGY

III YEAR – V SEMESTER

PAPER VII – IGNEOUS AND METAMORPHIC PETROLOGY

PAPER CODE-CREDIT

Broad Objectives & Methodology: Petrology is the foundation for field geology, stratigraphy, mineral exploration and others. The student is introduced to the basics of igneous and metamorphic petrology emphasizing processes, field geology, classification and others. The teaching and learning methodology involves class lectures and practical, field identification demonstrations, and microscopic techniques. **Learning Outcomes:** The student gains useful insight into igneous and metamorphic petrology. This expertise may be used in field geology and laboratory studies of rocks.

IGNEOUS PETROLOGY

UNIT-I:

Igneous Petrology: definition and scope. Magma: definition, composition and constituents of magma. Crystallization of a unicomponent magma: Augite system. Crystallization of binary

magma: Diopside-Anorthite system – simple eutectic. Albite – Anorthite system – solid solution series. Forsterite – Silica system – incongruent melting. Crystallization of a ternary system: Diopside – Anorthite – Albite. Bowen's Reaction Series. Mechanism and processes of magmatic differentiation.

UNIT-II:

Field configurations of igneous rocks: intrusive forms and extrusive forms. Textures and microstructures of igneous rocks. Assimilation of host rocks by magmas. Classification of igneous rocks based on: mode of occurrence, silica and alumina saturation, chemical and mineralogical schemes and Tyrell's tabular classification.

UNIT-III:

Outline of petrography of acid rocks, intermediate rocks, and basic rocks. Descriptive study of lamprophyre, carbonatite, anorthosites, dunite, pyroxenite and kimberlite. A short note on: consanguinity, kindred, petrographic provinces and periods. Short account of Harker's variation diagram.

METAMORPHIC PETROLOGY

UNIT-IV:

Metamorphism: definition and scope. Agents and kinds of metamorphism. Metamorphic zones and grades. Concept of metamorphic facies and its applications. Textures and structures of metamorphic rocks. Outline of crystalloblastic series and its applications. Metasomatism and metasomatic processes. Pneumatolytic and injection metamorphism. Contact or Thermal metamorphism of pelitic sediments and calcareous rocks. Cataclastic metamorphism and its products.

UNIT-V:

Regional metamorphism of argillaceous, calcareous, and impure calcareous rocks and their products. Plutonic metamorphism and its products. Short notes: retrograde metamorphism, anatexis and palingenesis. Descriptive petrography of the following metamorphic rocks; slate, phyllite, quartzite, schist, gneiss, migmatite, granulite, charnockite, amphibolite, eclogites, hornfels, and marble.

REFERENCE AND TEXTBOOKS

1. **Tyrell, G.W.** (1958). Principles of Petrology. B.I. Publications. New Delhi.
2. **Haung, W.T.** (1962). Petrology. McGraw Hill. New York.
3. **Winter, J.D.** (2010). Principles of Igneous and Metamorphic Petrology. PHI. New Delhi.
4. **Williams, H.** et al. (1982). Petrography. CBS. New Delhi.
5. **McBirney, A.R.** (1993). Igneous Petrology. CBS. New Delhi.
6. **Best, M.G.** (2005). Igneous Petrology. Wiley. New Delhi.

7. **Best, M.G.** (2003). *Igneous and Metamorphic Petrology*. Wiley. New Delhi.
8. **Hatch, F.H.** et al. *Petrology of the Igneous Rocks*. CBS. Delhi.
9. **Hyndman, D.W.** (1985). *Petrology of the Igneous and Metamorphic Rocks*. McGraw Hill. New York.
10. **Middlemost, E.A.K.** (1985). *Magmas and Magmatic Rocks*. Longman. UK.
11. **Winkler, H.G.F.** (1970). *Petrology of the Metamorphic Rocks*. Springer. New Delhi.
12. **Turner, F.J.** (1968). *Metamorphic Petrology*. McGraw Hill. New York.

Additional Resources

Igneous and metamorphic petrology related materials are available in CD/DVD format in the Department on written request. Web related materials are also available in the Department.

Assignments

Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks

Field excursion to a known area under proper supervision and submission of a field report.

B.Sc., GEOLOGY

III YEAR - V SEMESTER - PART –III MAJOR BASED ELECTIVE 1 - MBE 1 -

HYDROGEOLOGY

PAPER CODE

CREDIT

Broad Objectives & Methodology: The student is introduced to the basic principles of hydrogeology. The methodology of teaching involves class lectures and simple laboratory demonstrations. **Learning Outcomes:** The student gains insight into the basic principles of hydrogeology.

Unit: I

Definition and scope of Hydrogeology. Concise account of the hydrologic and hydrogeological cycle. Origin and sources of groundwater: meteoric water, connate water and juvenile water. Vertical distribution of groundwater. Rock properties affecting groundwater occurrence in rocks: porosity: primary and secondary, factors controlling porosity.

Unit: II

Specific yield and specific retention. D'Arcy's Law and its limitations. Laminar and turbulent flow. Permeability and permeameters. Coefficient of permeability. Water springs and their types. Water wells: definition and types.

Unit III

Aquifers: definition and types of aquifers: unconfined, confined, leaky and perched aquifers. Confining layers of aquifers: aquitard, aquifuge and aquiclude. Isotropic, anisotropic aquifers and layered aquifers. Aquifer properties: transmissivity, storativity, and compressibility. Artesian wells. Determination of subsurface water flow: field and graphical methods.

Unit: IV

Groundwater exploration: Outline of field geological, remote sensing, and resistivity methods. Outline of drilling techniques for groundwater. Artificial and natural recharge of groundwater. Brief account of rain water harvesting. Fluctuations of groundwater levels.

Unit V

Groundwater Quality and Chemistry: salinity and its causes. Physical criteria of water quality. Chemical analyses of groundwater and units used. TDS and hardness of ground water. Biological analysis of groundwater. Short account of water quality standards. Outline of groundwater provinces of Tamil Nadu.

Reference and Textbooks

1. **Todd, D.K.** (2008). Groundwater Hydrology. 5th ed. Wiley. New Delhi.
2. **Davis, S.N. & R.J.M. DeWiest.** (1966). Hydrogeology. Wiley. Delhi.
3. **Freeze, R.A. & J.A. Cherry.** (1979). Groundwater. Prentice Hall. New York.
4. **Raghunath, H.M.** (1988). Groundwater. East West Pub. Delhi.
5. **Raghunath, H.M.** (1985). Hydrology. East West Pub. Delhi.
6. **Fetter, G.W.** (1989). Applied Hydrogeology. CBS. Delhi.
7. **Ramakrishnan, S.** (2011). Ground Water. Scitech Publications. Chennai.
8. **Garg, S.P.** (1982). Groundwater and Tube Wells. Oxford & IBH. Delhi.

Additional Resources

Web resources related to the above subjects are available in the Department.

Assignments

Any two assignments (within the five units) may be suggested by the Teacher.

B.Sc., GEOLOGY

III YEAR - V SEMESTER - PART – IV SKILL BASED ELECTIVE PAPER – 3 - SBE III - REMOTE SENSING

PAPER CODE: **CREDIT:**

Broad Objectives & Methodology: The student is introduced to the principles and methods of Remote Sensing relevant to Geology with applications. The methodology of teaching involves class lectures, practical, study of aerial photos and digital imageries for geological applications.

Learning Outcomes: The student gains insight of the applications and uses of Remote Sensing.

Unit-I

Definition and scope of Remote Sensing in Geology. Electromagnetic spectrum – definition and components. Energy sources and radiation – outline of interaction of electromagnetic spectrum with atmosphere and earth surface features – spectral signatures – atmospheric windows.

Unit-II

Types of remote sensing: based on 1) Energy sources: active and passive. 2) Platforms: aerial and satellite and 3) Sensors: optical, thermal, and microwaves. 4) RADAR. Aerial remote sensing: Types of Aerial Photographs: vertical and oblique. Scale of aerial photographs – flight procedures. Stereoscopes : pocket and mirror stereoscopes.

Unit-III

Photo interpretation elements. Mosaics: controlled and uncontrolled mosaics – advantage and disadvantages – application of mosaics in geology studies. Satellite remote sensing: Principles of optical remote sensing: Satellite orbiting mechanisms – Brief account of multi spectral scanning – along track and across track scanning. Types of resolution – data acquisition and interpretation.

Unit-IV

Thermal Remote Sensing: Thermal radiation principles – atmospheric windows – advantages and disadvantages. SLAR – principle and applications. A short account of LANDSAT, SPOT and India Remote Sensing satellites. Indian Space Missions.

Unit-V

A short account of the remote sensing techniques in the study of drainage patterns, major land forms, geological structures. Ground water exploration and mineral exploration.

REFERENCES AND TEXTBOOKS

1. **Curran,P.B.** (1985).Principles of Remote Sensing. ELBS. London.
2. **Drury,S.D.** (1993). Image Interpretation in Geology. Allen & Unwin. London.
3. **Miller,V.C.** (1961). Photogeology. McGraw Hill. New York.

4. **Pandey,S.N.** (1989). Principles and Applications of Photogeology. Wiley Eastern. New Delhi.
5. **Sabins,F.F.** (1974). Remote Sensing Principles and Interpretation. Freeman. New York.
6. **Reddy,A.** (2010). Principles of Remote Sensing and GIS. CBS. Delhi.
7. **Guptha,R.P.** (2003). Remote Sensing Geology. Springer. New Delhi.
8. **Lillisand,T.M & R.W.Kiefer.** (2000). Remote Sensing and Image Interpretation. Wiley. Delhi.

Additional Resources:

Remote Sensing related materials are available in CD/DVD format in the Department.

Assignments

Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks

Interpretation of selected imageries and their field verification is suggested under proper supervision and with the submission of a field report.

B.Sc., GEOLOGY

III YEAR – V SEMESTER

PART –IV SKILL BASED ELECTIVE PAPER – 5 : SBE V - GEMMOLOGY

Paper Code

CREDIT

Broad Objectives & Methodology: To introduce the student to the basics of gemmology, gemstone exploration and its exploitation, gemstone processing and cutting techniques, and to the marketing of finished gems. The topics emphasize the significance of gemmology as an avenue for future self employment. Class lectures and practical, field identification demonstrations, and laboratory techniques. **Learning Outcomes:** The student gains insight into the methods of gemstone identification and exploration. This expertise may be useful in the particular field of gemmology the student wishes to pursue for employment.

Unit I

Definition and scope of Gemmology. Minerals as gemstones. Classification of gemstones: gem minerals and other schemes. Characteristic and desirable features of gemstones. Weight standards used in gemmology and metal jewellery.

Unit II

Identification of Gemstones: Basic megascopic and optical properties of gemstones. Gemstone testing equipment: Gemstone Refractometers, Polaroid films or plates, Gemstone microscope, Hardness testing kits, Heavy liquids, UV light, and Spectroscope methods. Gem simulants, proxies, and synthetic gemstones – their identification from natural gemstones.

Unit III

Introduction to exploration techniques used in gemstone prospecting. Host rocks for gemstone mineralization and gemstone deposits. Outline of gemstone extraction and mining from host rock. Processing of gemstones for cutting and polishing.

Unit IV

Cutting and polishing techniques applied to different gemstones. Small scale gemstone cutting and polishing industries in Tamil Nadu. Feasibility and economics of gemstone related industries in India (with emphasis on Tamil Nadu).

Unit V

Outline of important gemstone provinces in India. Gemstone areas of Tamil Nadu: Karur – Kangeyam belt, Sittampundi Area, Samalpatti Area, Pakkanadu – Mulakkadu Area, and Edappadi Area. Brief outline of mining regulations relevant to gemstone mining in India.

REFERENCE AND TEXTBOOKS

1. **Karant, R.V.** (2000). Gem and gem industry in India, Memoir 45, Geological Society of India, Bangalore.
2. **Babu, T.M.** (1998). Diamond in India, Economic Geology Series 1, Geological Society of India, Bangalore.
3. **Hall, C.** (2005). Gemstones, Dorling Kindersley, London.
4. **Sinkankas, J.J.** (1964). Mineralogy: A first Course, Van Nostrand Reinhold, New York.
5. **Krishnan, M.S.** (1964). Mineral Resources of Madras, Memoir Vol 80, Geological Survey of India, Kolkata.
6. **Prasad, U.** (2003). Economic Mineral Deposits, CBS Publishers, New Delhi.
7. **Read, P.G.** (1984). Beginner's Guide to Gemmology, Heinemann Professional Publishing Ltd, London.
8. **O'Donoghue, M.** (2006). Gems. Elsevier, Singapore.
9. **Keller, P.C.** (1990). Gemstones and their origins, Van Nostrand Reinhold, New York.
10. **Herbert Smith, G.F.** (1912). Gemstones. Methuen, London.
11. **Read, P.G.** (2005). Gemmology, 3rd ed. Elsevier, Singapore.
12. **Walton, L.** (2004). Exploration Criteria for Colored Gemstones, Open File – 2004 – 10. Canada.

Additional Resources: Gemmology related animations available in CD/DVD format in the Department. **Assignments:** Any two assignments (within the five units) may be suggested by the Teacher. **Suggested Group Work/Tasks:** Field excursion to a known gemstone bearing area under proper supervision and submission of a field report.

B.Sc., GEOLOGY

IIIYEAR - VI SEMESTER

PAPER VIII - SEDIMENTARY PETROLOGY AND ENVIRONMENTAL GEOLOGY

PAPER CODE

CREDIT :

Broad Objectives & Methodology: The student is introduced to the fundamentals of sedimentary petrology. Sedimentary petrology is the study of sedimentary rocks generated on the earth's crust. Environmental geology is the application and role of geology in the environmental perspective. The methodology of teaching involves class lectures, practical, and laboratory work.

Learning Outcomes: The student gains insight and understanding of sedimentary petrology and environmental geology.

SEDIMENTARY PETROLOGY

Unit-I

Definition and scope of Sedimentary Petrology. Sedimentary rocks: definition, origin, disintegration and decomposition of rocks. Transportation and deposition of sediments. outline of sedimentary processes. Classification of sedimentary rocks: Tyrell's classification, Megascopic classification. Textures of sedimentary rocks.

Unit-II

outline of depositional sedimentary environments. Structures of sedimentary rocks. Sedimentary residual deposits: soils, regolith, laterite, and terra rosa. Sedimentary mechanical deposits.

Unit-III

Sedimentary deposits of chemical origin: evaporite, siliceous, carbonate, ferruginous, and clay rich deposits. Sedimentary deposits of organic origin: calcareous, phosphatic, iron rich, and silica rich deposits. Petrographic description of: conglomerate, breccia, sandstone, shale and limestones.

ENVIRONMENTAL GEOLOGY

Unit-IV

Definition and scope of environmental geology. Classification and types of natural resources. Renewable and non renewable resources. Impact of man on the environment. Groundwater pollution: definition, types and remedial measures. Geological factors in environmental health. Trace elements and human health. Chronic disease and geological environment.

Unit V

Energy resources: definition, types, renewable and non-renewable energy resources. Environmental impact due to mining and mineral processing and its remediation. Coastal environments: definition, pollution in coastal areas, prevention of erosion along coasts. Types of human generated waste and outline of methods of disposal. outline of Environmental law in India.

REFERENCE AND TEXTBOOKS

1. **Tyrell, G.W.** (1958). Principles of Petrology. B.I. Publications. New Delhi.
2. **Haung, W.T.** (1962). Petrology. McGraw Hill. New York.
3. **Williams, H.** et al. (1982). Petrography. CBS. New Delhi.
4. **Greensmith, J.T.** (1976). Petrology of the Sedimentary Rocks. CBS. Delhi.
5. **Folk, R.L.** (1974). Petrology of the Sedimentary Rocks. Hemphill. Texas. USA.
6. **Keller, E.A.** (1985). Environmental Geology. Merrill. New York.
7. **Miller, T.G.** (2004). Environmental Science. Wadsworth Publishing. USA.
8. **Flawn, P.T.** (1970). Environmental Geology. Harper. New York.
9. **Coates, D.R.** (1984). Environmental Geology. McGraw Hill. New York.

Additional Resources: Sedimentary Petrology and Environmental Geology related materials are available in CD/DVD format in the Department. **Assignments:** Any two assignments (within the five units) may be suggested by the Teacher. **Suggested Group Work/Tasks:** Field excursion is suggested under proper supervision and with the submission of a field report.

B.Sc., GEOLOGY

III YEAR - VI SEMESTER

PAPER IX – ECONOMIC GEOLOGY

PAPER CODE CREDIT:

Broad Objectives & Methodology: The student is introduced to the basic principles of economic geology and mineral economics. The methodology of teaching involves class lectures with mineral sample study and simple laboratory demonstrations.

Learning Outcomes: The student gains insight into the basic principles of economic geology and mineral economics.

UNIT I:

Definition and Scope of Economic Geology. Concepts of: Ore, gangue, tenor, grade, host rock, and economic value. Brief outline of factors controlling the generation of materials of a Mineral Deposit. outline of Lindgren and Bateman's scheme of classification of mineral Deposits. Controls of ore deposit localization. outline of Metallogenic Epochs and Provinces.

UNIT II:

Processes of Ore Formation I: - Magmatic Concentration – Oxidation and Supergene Enrichment - Sublimation – Residual and Mechanical Concentration – Metamorphic – Metasomatism - Evaporation – Bacteriogenic.

UNIT III:

Processes of Ore Formation II: Hydrothermal: Cavity filling deposits and Replacement deposits. outline of ore shoots. Contact Metasomatism – Sedimentation. Mineralogy, association, mode of occurrence and distribution in India of the minerals used in the following Industries: abrasives – refractory – cement – glass – ceramics – fertilizer – paints and pigments.

UNIT IV:

Brief account of ore textures and structures. Ore mineralogy, association, genesis, mode of occurrence, and Indian distribution of the following metallic ore deposits: - Fe, Cu, Mn, Au, and Mo.

UNIT V:

Ore mineralogy, association, genesis, mode of occurrence, and Indian distribution of the following metallic ore deposits: - Al, Pb & Zn, and Cr. Mineral Economics: - Concept of strategic, critical and essential minerals – Demand and supply - Mineral conservation and substitution. Outline of National Mineral Policy and Mineral Concession Rules. Building stones: - definition – characters – classification – Outline of Indian distribution. Short account of granite industry in Tamil Nadu.

REFERENCE AND TEXT BOOKS:

1. Aiyengar, N.K.N. (1964). Minerals of Madras. Dept. of Industries & Commerce. Guindy, Madras.
2. Bateman, A.M. & M.L. Jensen. (1981). Economic Mineral Deposits. 3rd ed. Wiley. New York.
3. Edwards, R. & K. Atkinson. (1986). Ore Deposit Geology. Chapman & Hall. UK.
4. Krishnan, M.S. (1951). Mineral Resources of Madras. Memoir V.80. Geol. Surv. Ind. Kolkata.
5. Park, C.F. & M.A. MacDiarmid. (1970). Ore Deposits. Freeman. New York.
6. Prasad, U. (2003). Economic Mineral Deposits. CBS. Delhi.
7. Banerjee, D.K. (1998). Mineral Resources of India. World Press. Kolkata.
8. Deb, S. (1985). Industrial Minerals and Rocks of India. Oxford & IBH. Delhi.
9. Krishnasamy, S. (1988). India's Mineral Resources. Oxford & IBH. Delhi.
10. Sharma, N.L & R.K. Sinha. (1985), Mineral Economics. Oxford & IBH. Delhi.
11. Gokhale, K.V.G.K. & D.M. Rao. (1981). Ore Deposits of India. Oxford & IBH. Delhi.
12. Craig, R.C & D.V. Vaughan. (1985). Ore Microscopy and Ore Petrography. Wiley. New York.

Additional Resources: Web resources related to the above subjects are available in the Department. **Assignments:** Any two assignments (within the five units) may be suggested by the Teacher. **Suggested Group Work/Tasks:** Field visit to metallic ore deposit mines with proper permission is suggested with proper permission.

B.Sc., GEOLOGY
III YEAR - VI SEMESTER
PAPER X - MINING GEOLOGY AND ORE DRESSING

PAPER CODE CREDIT 5

Broad Objectives & Methodology

The student is introduced to the basic principles of mining geology and ore dressing. The methodology of teaching involves class lectures with problem solving exercises and simple laboratory demonstrations.

Learning Outcomes

The student gains insight into the basic principles of mining geology.

Unit I

Definition and scope of mining geology. **Methods of breaking over burden and rocks:** manual methods, mechanical methods, and utility of explosives in mining. **Sampling of mined materials:** channel, grab, chip, and bulk sampling. Sizing, pulverization, and coning and quartering of samples. Drilling: definition and purpose. **Drilling methods:** rotary, percussion, and diamond. Geological logging of bore hole samples.

Unit II

Open cast mining methods: Parts of an open cast Mine: over burden, surface adit, bench, slope, drop-cut, over-break. Open cast mining equipment: bull dozer, front end loader, poclairn, drag line with bucket, and wheel excavators. Strip mining and surface augering of coal beds and seams. Quarrying method for hard rocks. Glory hole mining.

Unit III

Alluvial mining of unconsolidated sediments and soft rocks. Hydraulic method – panning and sluicing of sediments. Dredging of off shore unconsolidated sediments.

Subsurface and underground mining methods: Components of an underground mine: adit, shaft, level, cross cut, drift, tunnel, winze, raise, stope, and foot-wall and hanging wall. Mine stoping methods: open stope, level stoping, supported stopes, square set stopes, pillar supported stopes, and shrinkage stopes.

Unit IV

Outline of Mine ventilation. Groundwater problems and their management in open cast and under ground mines. Modes of transportation of broken ore in open cast and underground mines. **Subsurface coal mining methods:** stope and pillar, long wall, room and pillar, and caving.

Unit V

Ore Dressing

Definition and scope of ore dressing in mining. Properties of minerals used in ore

beneficiation processes. Manual crushing of ores. Types of crushers: jaw, gyratory, and cone types; Types of grinders: tumbling, ball, and rod mills. Sizing and screening of crushed ores: purpose of screening, types of screens: Outline of fixed types and moving types. Outline of ore classifiers. Concentration of ores by jigging, floatation and magnetic separation. Outline of flows sheets used in ore dressing.

REFERENCE AND TEXTBOOK

1. **Arogyaswamy, R.N.P.** (1988). Courses in Mining Geology, Oxford & IBH, New Delhi.
2. **Singh, R.D.** (1998). Coal Mining. New Age Publishers, Delhi.
3. **Thomas, R.T.** (1986). Introduction to Mining methods. McGraw Hill, New York.
4. **Peters, W.C.** (1978). Exploration and Mining Geology, Wiley, New York.
5. **Hartman, H.L.** (1992). SME Mining Engineering Handbook, SME Colorado, USA.
6. **McKinstry, H.E.** (1948). Mining Geology, Asia Publishing House, Delhi.

Additional Resources

Web resources related to the above subjects are available in the Department.

Assignments

Any two assignments (within the five units) may be suggested by the Teacher.

Suggested Group Work/Tasks

Field visit to mines with proper permission.

B.Sc., GEOLOGY

III YEAR - VI SEMESTER

PART –III MAJOR BASED ELECTIVE – 2 - MBE 2 - EXPLORATION GEOLOGY AND MINERAL FUELS

PAPER CODE

CREDIT

Broad Objectives & Methodology: The student is introduced to the basic principles of exploration and mineral fuels. The methodology of teaching involves class lectures with simple laboratory demonstrations. **Learning Outcomes:** The student gains insight into the basic principles of exploration and mineral fuels.

I. Exploration Geology: Geological and Geochemical Exploration

Unit I

Guides to ore deposits: Mineralogic, lithologic, structural, stratigraphic, and physiographic. Controls of ore localization. Sampling of ores and minerals: definition and types of samples.

Outline of sampling methodology. **Geochemical Exploration:** definition and scope. Basic principles: Concepts of background, threshold, and anomalous values. Distribution of elements around ore bodies: primary, secondary, and leakage haloes. Outline of lithochemical and hydrogeochemical methods.

II. Geophysical Exploration

Unit II

Gravity Method: Definition of gravity. Newton's Law of Gravitation. Gravity measurements: Absolute and relative. Gravity units. Gravimeters: Outline of Stable and Unstable gravimeters. Gravity Surveys. Applications and limitations of gravity methods. **Magnetic Methods:** Components of earth's magnetic field. Magnetic character of rocks and minerals. Units of measurement. Magnetometers: Types. Magnetic surveys. Applications and limitations of magnetic methods.

Unit III

Electrical Methods: Definition – Ohm's Law – Resistivity and conductivity – Electrical properties of rocks and minerals - Units of measurement. Resistivity surveying equipment. Electrode configurations: Wenner – Schlumberger. Applications and limitations of resistivity methods. **Seismic Methods:** General principles. Methods of generating artificial seismic waves. Geophones – types and their limitations. Recording equipment. **Refraction Methods:** Principle – Instruments and equipment – Field Methods: Fan, Arc, and Profile shooting. **Reflection Methods:** Principle - Instruments and equipment – Field Operations: Shot point and Detector spreads. Applications and limitations.

MINERAL FUEL GEOLOGY

III. Coal Geology and Radioactive Minerals

Unit IV

Definition of coal geology and its scope. Coal: definition, types and rank of coal. Outline of chemical and physical characters of coal. Origin of coal. Outline of Coalification process. Indian Coal deposits: Gondwana Coal and Tertiary Lignite. **Radioactive Minerals:** definition, radioactive minerals and their host rocks. Outline of Geiger Muller Counter. Distribution of radioactive minerals in India with special reference to Tamil Nadu.

IV. Petroleum Geology

Unit V

Definition of Petroleum Geology and its scope. Petroleum: definition, composition, physical properties. Outline of origin. Migration of petroleum. Petroleum Traps and seals. Reservoir rocks and their properties. Oil window. Concept of Kerogen. Oil fields of India: Assam, Gujarat,

Bombay High and Cauvery basin. Short account of Natural Gas deposits in India. Natural gas hydrates: definition and Outline of uses.

REFERENCE AND TEXTBOOKS

1. **Banerjee, P.K. & S.Ghosh.** (1997). Elements of Prospecting for Non Fuel Mineral Deposits. Allied. Chennai.
2. **Arogyaswamy, R.N.P.** (1980). Courses in Mining Geology. Oxford & IBH, New Delhi.
3. **Hawkes, H.E.** (1959). Principles of Geochemical Prospecting. Bulletin 1000F. USGS.
4. **Moon, C.J et al.** (2006). Introduction to Mineral Exploration. Wiley Blackwell. New Delhi.
5. **Ramachandra Rao, M.B.** (1993). Outline of Geophysical Prospecting. EBD Publishers, Dhanbad.
6. **Kearey, P. et al.** (2002). An Introduction to Geophysical Exploration. Wiley. Delhi.
7. **Mussett, A.E. & Khan, M.A.** (2000). Looking into the Earth. Cambridge University Press, New Delhi.
8. **Sharma, P.V.** (2005). Environmental and Engineering Geophysics. Cambridge University Press. Delhi.
9. **Prasad, U.** (2003). Economic Mineral Deposits. CBS. Delhi.
10. **Banerjee, D.K.** (1998). Mineral Resources of India. World Press. Kolkata.
11. **Deb, S.** (1985). Industrial Minerals and Rocks of India. Oxford & IBH. Delhi.
12. **Krishnasamy, S.** (1988). India's Mineral Resources. Oxford & IBH. Delhi.
17. **Sharma, N.L. & R.K. Sinha.** (1985), Mineral Economics. Oxford & IBH. Delhi.
14. **Gokhale, K.V.G.K. & D.M. Rao.** (1981). Ore Deposits of India. Oxford & IBH. Delhi.

Additional Resources & Assignments: Web resources related to the above subjects are available in the Department. Any two assignments (within the five units) may be suggested by the Teacher.

B.Sc., GEOLOGY
III YEAR - VI SEMESTER
PART –III MAJOR BASED ELECTIVE – 3: MBE III - ENGINEERING GEOLOGY,
COMPUTER APPLICATIONS IN GEOLOGY
AND GEOSTATISTICS

PAPER CODE CREDIT

Broad Objectives & Methodology: The student is introduced to the basic principles of engineering geology, computer application in geology, and geostatistics. The methodology of teaching involves class lectures with simple laboratory demonstrations.

Learning Outcomes: The student gains insight into the basic principles of engineering geology, computer application in geology, and geostatistics.

ENGINEERING GEOLOGY

UNIT I

Definition and scope of Engineering Geology. Engineering properties of rocks. Soils: definition and engineering properties. Geological Investigations in engineering sites. Slope stability: definition, slope failure and safety, geological factors, groundwater conditions and remedial measures.

Unit II

Dams: definition, types, geological conditions, and site investigations. Short note on dam foundations and geological conditions. Outline of important Indian Dams. Reservoirs: definition, selection of reservoir sites, and groundwater conditions. Problems in reservoirs: sedimentation, slope control, leakage and seismicity. Short account of Indian reservoirs.

Unit III

Tunnels: definition, parts of a tunnel, types, tunnelling in hard and soft rocks, geological investigations, and groundwater conditions. Foundations: definition, geological investigations, and ground water problems. Outline of support structures: rods, bolts, anchors, arches, rings, linings, and retaining walls.

COMPUTER APPLICATIONS IN GEOLOGY

Unit IV

Introduction to flow charts and algorithms. Outline of system configuration for geologically oriented software: GIS and digital mapping software. A short account of: Aqua, Stereoplot,

Stereowin, Petrograph, Rockware, and Surfer. Use of Excel spread sheets in Petrology, Hydrogeology and Geostatistics.

GEOSTATISTICS

Unit V

Definition and scope of statistics in Geology. Measures of central tendency. Distributions – Scales – population. Brief introduction to sampling methods. Outline of errors in sampling. Variables; Tabulation; Introduction to probability. Simple correlation and linear regression. Outline of graphical methods in statistics: bar chart, pie diagram, and XY graph. Outline of application of statistics in geology.

REFERENCE AND TEXT BOOKS:

1. **Bell,F.G.**(2005).Fundamentals of Engineering Geology. B.S.Publications. Hyderabad.
2. **Krynine,P.D. & W.R. Judd.**(1956). Principles of Engineering Geology & Geotechnics. CBS. Delhi.
3. **Legget,R.F. & A.W.Hatheway.**(1988). Geology and Engineering. 3 rd ed. McGraw Hill. New York.
4. **Blyth,F.G.H. & M.H.De Freitas.**(1984).A Geology for Engineers. 7th ed. Elsevier. New Delhi.
5. **Parbin Singh,B.**(2005). A Textbook of Engineering and General Geology. S.K.Kataria & Sons.Delhi.
6. **Ravichandran,D.**(2001). Introduction to Computers and Communication. Tata McGraw Hill.Delhi.
7. **Guptha,S.**(2004). Basic Statistics. S.Chand & Sons. Delhi.
8. **Davis,J.C.** (1985). Statistical and Data Analysis in Geology.Wiley. Delhi.
9. **Guptha,S.**(1990). Statistical Methods. S.Chand & Sons. Delhi.

Additional Resources: Web resources related to the above subjects are available in the Department.

Assignments: Any two assignments (within the five units) may be suggested by the Teacher.

B.Sc., GEOLOGY
III Year - VI Semester
PRACTICAL III - MINERALOGY AND PETROLOGY

PAPER CODE CREDIT 4

Practical Examination Maximum Marks: 60

Practical Examination Marks: 50

Records: 10

Marks for Internal Assessment: 40

MINERALOGY:

A. MEGASCOPIY

Megascopic Identification of rock forming silicate on the basis of their physical properties, chemical composition and determination of system of crystallization of the following groups of minerals:

Quartz Group: Rock Crystal, Blue quartz, Smoky quartz, Chalcedony, Opal, Agate, Flint, Jasper, Amethyst.

Feldspars Group: Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Anorthite, Perthite.

Feldspathoid Group: Nepheline, Sodalite, Lazurite.

Pyroxene Group: Enstatite, Bronzite, Hypersthene, Augite, Diopside, Rhodonite, Wollastonite.

Amphibole Group: Anthophyllite, Actinolite, Tremolite, Hornblende, Glaucophane.

Mica Group: Muscovite, Biotite, Phlogopite, Lepidolite, Vermiculite.

Alumina Group: Kyanite, Sillimanite, Andalusite.

Zeolite Group: Leucite, Natrolite, Apophyllite, Stilbite.

Miscellaneous

Silicates:

Olivine, Garnet, Beryl, Zircon, Cordierite, Talc, Steatite, Kaolin, Topaz, Tourmaline.

Non-Silicates: Apatite, Calcite, Dolomite, Fluorite.

B. MINERAL MICROSCOPY

Petrographic identification of mineral thin sections based on their crystallography and diagnostic optical properties.

Isometric Minerals: Garnet, Fluorite, Analcite, Spinel, Sodalite, Scapolite.

Tetragonal Minerals: Zircon, Leucite, Apophyllite, Rutile.

Hexagonal Minerals: Quartz – basal and non basal, Tourmaline, Calcite, Dolomite, Beryl, Corundum,

Orthorhombic Minerals: Olivine, Hypersthene, Cordierite, Andalusite, Sillimanite

Monoclinic Minerals :

Staurolite, Orthoclase, Augite, Aegirine, Diopside, Spodumene, Muscovite, Biotite, Chlorite, Epidote, Hornblende, Sphene, Serpentine, Stilbite, Actinolite, Tremolite,

Triclinic Minerals: Microcline, Albite, Oligoclase, Andesine, Anorthite, Labradorite, Kyanite.

C. ROCK MEGASCOPIY

Megascopic identification of rocks based on petrographic characters, mineralogy, and other diagnostic megascopic features.

I. Igneous Rocks:

Acid Igneous Rocks: Granites: graphic granite, aplite, pegmatite, tourmaline granite, schorl rock, pyroxene granite, hornblende granite, mica granite, pink granite, porphyritic granite, granodiorite.

Intermediate Igneous Rocks: Syenites: quartz syenite, corundum syenite, nepheline syenite, perthitic syenite, pyroxene syenite, hornblende syenite, mica syenite, porphyritic syenite, diorite,

Basic Igneous Rocks: Gabbros: gabbro, norite, dolerite.

Ultrabasic Igneous Rocks: anorthosite.

Ultramafic Igneous Rocks: dunite, peridotite, pyroxenite.

Alkaline Igneous Rocks: lamprophyre, carbonatite, kimberlite.

Volcanic Igneous Rocks: basalts: vesicular, amygdaloidal, vitrophyric basalt. pitchstone, scoria, pumice, obsidian, rhyolite, rhyodacite, trachyte.

II. Metamorphic Rocks

Regional Metamorphic Rocks: slate: colored and porphyroblastic varieties; phyllite; schists: mica, kyanite, amphibole, and talc; gneisses: banded, garnetiferous, injection type, migmatite varieties; amphibolite; eclogite; granulites: charnockite types; khondalite; gondite; grodurite; leptynite.

Contact Metamorphic Rocks: marble, quartzite, skarn, hornfels.

III Sedimentary Rocks

Clastic Rocks: sandstone and its varieties; breccias; conglomerate; shale and its varieties; greywackes.

Non-clastic rocks: limestone and its varieties; flint; chert;

Coal: peat, lignite, bituminous, and anthracite.

D. ROCK MICROSCOPY

Petrographic identification of rock thin sections based on their petrographic characters, mineralogy and diagnostic features.

Igneous Rocks:

Graphic granite, aplite, pegmatite, tourmaline granite, schorl rock, hornblende granite, mica granite, pink granite, porphyritic granite, granodiorite; quartz syenite, nepheline syenite, perthitic syenite,

pyroxene syenite, hornblende syenite, mica syenite, porphyritic syenite, diorite; gabbro, norite, dolerite; anorthosite; dunite, peridotite, pyroxenite; lamprophyre, carbonatite, kimberlite; basalts: vesicular, amygdaloidal, vitrophyric basalt. pitchstone, scoria, pumice, obsidian, rhyolite, rhyodacite, trachyte, phonolite.

Metamorphic Rocks:

Slate, phyllite, schists, mica, kyanite, amphibole, and talc; gneisses: banded, garnetiferous, injection type, migmatite varieties; amphibolite; eclogite; granulite: charnockite; khondalite; gondite; grodurite; leptynite; marble, quartzite, skarn, hornfels.

Sedimentary Rocks:

Sandstone and its varieties; breccias; conglomerate; shale and its varieties; greywackes; limestone and its varieties; flint; chert;

FIELD TRAINING PROGRAMME: III Year of the Course.

In part fulfilment of the B.Sc., Applied Geology degree course, the students should be taken to areas of geological importance for a period of 5 to 7 days, to collect rock and mineral samples for megascopic and microscopic study in the laboratory. They should present the collected specimens and submit a report on the field training at the time of the Main Practical Examination.

Internal Assessment Marks for the practical are given below:

Attendance in Practical Classes: 5 marks;

Practical Tests: 10 marks.

Full Attendance during field training, collection, and submission of field report: 25 marks.

Total: 40 marks.

B.Sc., GEOLOGY
III YEAR - VI SEMESTER
PART- IV SKILL BASED ELECTIVE PAPER – 6: SBE VI - ECONOMIC MINERALS,
GEOCHEMISTRY
AND FIELD GEOLOGY PRACTICAL

PAPER CODE CREDIT

Practical Examination Maximum Marks: 55

Practical Examination Marks: 50

Records: 5

Marks for Internal Assessment: 20

Broad Objectives & Methodology: The student is introduced to the different laboratory based methods and techniques relevant to field and geology and geological mapping. The methodology of teaching involves class lectures with problem solving exercises and simple laboratory demonstrations. **Learning Outcomes:** The student gains some expertise by using the different laboratory based methods and techniques relevant to field and geology and geological mapping.

Syllabus:

1. Determination of strike, dip, trend and plunge of geological structures or features using Clinometer Compass and Brunton Compass.

2. Identification of geomorphologic features and major drainage patterns from scaled Aerial Photographs.

3. Identification of the following gem stones:

Diamond, ruby, sapphire, topaz, quartz, amethyst, agate, opal, jasper, cats-eye, diopside, moonstone, labradorite, sodalite, lazurite, beryl, garnet, kyanite.

4. Megascopic identification of industrial and ore minerals:

Industrial Minerals: magnesite, gypsum, asbestos, fluorite, calcite, graphite, barite, talc, witherite, strontianite, anhydrite, halite, dolomite, aragonite, kaolin, garnet, corundum, phosphate nodule.

Ore minerals: **Fe ores:** magnetite, hematite, limonite, pyrite, marcasite and siderite. **Cu ores:** chalcopyrite, cuprite, bornite, malachite, azurite, native copper. **Mn ores:** pyrolusite, psilomelane, rhodochrosite, and rhodonite. **Pb ores:** galena, cerussite, anglesite. **Zn ores:** smithsonite, sphalerite. **Sn ore:** cassiterite. **As and Sb ores:** realgar, orpiment, stibnite. **Other ores:** wolframite, molybdenite, bauxite, chromite, ilmenite, rutile, cinnabar. **Radioactive Ores:** monazite, zircon, pitchblende, and pyrochlore.

5. Qualitative Analysis of Ores using the method of Blow pipe.

Calcite, dolomite, magnesite, gypsum, bauxite, apatite, anhydrite, celestite, barite, magnetite, hematite, chromite, galena, pyrolusite, psilomelane, stibnite, sphalerite, cuprite, wolframite, malachite, and

smithsonite.

6. Determination of pH value of groundwater samples.

7. Determination of elemental concentration of select prepared ore solutions by Spectrophotometer.