

**PERIYAR UNIVERSITY**  
**PERIYAR PALKALAI NAGAR**  
**SALEM-636 011**



**DEGREE OF MASTER OF SCIENCE**

**M.Sc., GEOLOGY**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**REGULATION AND SYLLABUS**

**For Affiliated Colleges**

**Effective from the academic year 2018-2019 onwards**

**2018**

M.Sc., GEOLOGY  
CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

M.Sc Geology programme is being offered under Choice Based Credit System (CBCS). The CBCS enables the students to select varieties of subjects as per her /his interest and requirement. Acquiring knowledge in the related discipline is advantageous to the students. The CBCS programme is framed in such a way that to impart more Knowledge in the field of Earth Science.

Condition for Admission

A candidate who has passed B.Sc degree in Applied Geology/ Geology of this university or an examination of any other university accepted by the Syndicate as equivalent there to shall be permitted to appear and qualify for the M.Sc Geology (CBCS) Degree examinations of this university after a course of two academic years.

Core courses

Core courses are compulsory basic subjects in the programme offered by the department. Each core course carries 4 credits. Core courses offered by one department will not be treated as elective by other. Core courses include theory, practical, project work, field training and industrial visits. Students can be permitted to carry out project works at reputed institutions and industries.

Elective courses

Elective courses (disciplinary) are offered by the parent department. Each elective course carries 3 credits.

Extra Disciplinary Elective Subject

Extra Disciplinary Elective Subject courses are aimed at bridging the gap in the curricula and to learn advancement in branch disciplines. Each elective disciplinary elective subject course carries 3 credits.

Compulsory Course

A course on Human rights is compulsory in the II semester.

Semester

An academic year consists of two semesters. The Normal semester periods are

- Odd Semester : July to November
- Even Semester: December to April

Each semester has 18 (eighteen) teaching weeks with working hours spread over 5 days a week.

Credits

The term credit is used to describe the quantum of syllabus for various programmes in terms of hours of study. It indicates differential weightage given according to the contents and duration of the courses in the curriculum design. The minimum credit requirement for a two-year Master's programme shall be 90.

Course weightage

A course carrying one credit for lectures will have instruction of one period per week during the semester. If four hours of lecture are necessary in each week for that course, then 4 credits will be the weightage. Thus, normally in each of the courses, credits will be assigned on the basis of the lectures/ tutorials/ laboratory work and other forms of learning in a 18-week schedule.

### Evaluation

Evaluation will be done on a continuous basis during the course work through class test and midterm exams. Evaluation may be done by objective type questions, short answers, essays or a combination of these, but the end semester examination is a written examination.

### Field visits / Mine training/ Internship training

1. Geological mapping: Two weeks field geological mapping in between I<sup>st</sup> and II<sup>nd</sup> semester. Students should submit report along with neat sketches.
2. Mine Training: 15 days mine training in selected mine-sites in between 2<sup>nd</sup> and 3<sup>rd</sup> semester. Students should submit mine training in the form of a report.
3. Geological Tour: Ten to fifteen days, geological tour of selected locations in between 2<sup>nd</sup> and 3<sup>rd</sup> semester. Based on tour, students have to submit a report.
4. Students should undergo internship training in the public and private sectors and submit their report for evaluation at the end of the semester Examination

**Syllabus for M.Sc., Geology**  
**Curriculum and Scheme of Examinations**

S.NO	COURSE	SUBJECT CODE	TITLE OF THE PAPERS	CREDIT	Ins. Hrs/ Week	MARKS		
						IA	EXT. EXAM	TOTAL
	SEMESTER I							
1.	CORE I	18GEOC1	GEOMORPHOLOGY AND GEODYNAMICS	4	5	25	75	100
2.	CORE II	18GEOC2	PALAEONTOLOGY	4	5	25	75	100
3.	CORE III	18GEOC3	ADVANCED CRYSTALLOGRAPHY AND OPTICAL MINERALOGY	4	5	25	75	100
4.	CORE PRACTICAL I	18GEOP1	CRYSTALLOGRAPHY, MINERALOGY AND FIELD WORK PRACTICAL I		5			
5.	CORE PRACTICAL II	18GEOP2	STRUCTURAL GEOLOGY, REMOTE SENSING AND PALEONTOLOGY PRACTICAL II		5			
6.	MAJOR ELECTIVE I	18GEOE1	REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)	3	3	25	75	100
			Total	15	28	100	300	400
	SEMESTER II							
1.	CORE IV	18GEOC4	MINERALOGY	4	4	25	75	100
2.	CORE V	18GEOC5	STRUCTURAL GEOLOGY	4	4	25	75	100
3.	CORE VI	18GEOC6	STRATIGRAPHY	4	4	25	75	100
4.	CORE PRACTICAL I	18GEOP1	CRYSTALLOGRAPHY, MINERALOGY AND FIELD WORK PRACTICAL I*	4	5	40	60	100
5.	CORE PRACTICAL II	18GEOP2	STRUCTURAL GEOLOGY, REMOTE SENSING AND PALEONTOLOGY PRACTICAL II*	4	5	40	60	100
6.	MAJOR ELECTIVE II	18GEOE2	FUEL GEOLOGY	3	4	25	75	100
7.	EDES I	18GEOES1	NATURAL HAZARDS MITIGATION AND MANAGEMENT	3	2	25	75	100
8.	COMPULSORY	18PHR01	HUMAN RIGHTS - DUTIES	3		25	75	100
			Total	29	28	230	570	800
	SEMESTER III							
1.	CORE VII	18GEOC7	IGNEOUS PETROLOGY	4	4	25	75	100
2.	CORE VIII	18GEOC8	SEDIMENTARY AND METAMORPHIC PETROLOGY	4	4	25	75	100
3.	CORE PRACTICAL III	18GEOP3	PETROLOGY AND FIELD WORK II PRACTICAL III		4			
4.	CORE PRACTICAL IV	18GEOP4	ECONOMIC GEOLOGY AND APPLIED GEOLOGY PRACTICAL IV		5			
5.	MAJOR ELECTIVE III	18GEOE3	HYDROGEOLOGY	3	4	25	75	100
6.	MAJOR ELECTIVE IV	18GEOE4	ENVIRONMENTAL GEOLOGY	3	4	25	75	100
7.	EDES II	18GEOES2	MARINE GEOLOGY AND QUATERNARY GEOLOGY	3	3	25	75	100
8.	INTERNSHIP*	18GEOIS	INTERNSHIP TRAINING	2			100	100
			Total	19	28	125	475	600
	SEMESTER IV							
1.	CORE IX	18GEOC9	ECONOMIC GEOLOGY AND MINERAL ECONOMICS	4	5	25	75	100
2.	CORE X	18GEOC10	APPLIED GEOLOGY	4	5	25	75	100
3.	CORE PRACTICAL III	18GEOP3	PETROLOGY AND FIELD WORK PRACTICAL III*	4	6	40	60	100
4.	CORE PRACTICAL IV	18GEOP4	ECONOMIC GEOLOGY AND APPLIED GEOLOGY PRACTICAL IV*	4	6	40	60	100
5.	MAJOR ELECTIVE V	18GEOE5	GEOPHYSICS, GEOCHEMISTRY AND GEOCHRONOLOGY	3	4	25	75	100
6.	CORE PROJECT	18GEOPV	PROJECT & VIVA VOCE	8	4	50	150	200
			Total	27	30	205	495	700
			TOTAL	90		660	1840	2500

Note: \*Practical examination will be held at the even semesters

**Allotments of Credits**

Core Course	:	56
Elective Course	:	15
EDES	:	06
Internship	:	02
Human Rights	:	03
Project	:	08
Total	:	90

**Allotments of Papers**

Core Papers	:	10
Core Practical's	:	04
Elective Papers	:	05
EDES	:	02
Internship	:	01
Human Rights	:	01
Project	:	01

**Distribution of Marks****Theory**

University Examination (External)	:	75 marks
Internal Assessment	:	25 marks

**Distribution of Internal Assessment mark**

Test	:	10 marks
Attendance	:	5 marks
Assignment	:	5 marks
Seminar	:	5 marks

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Total	:	25 marks
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Passing Minimum : Internal Assessment	:	50% - 12 marks
Passing Minimum : External Assessment	:	50% - 38 marks
Total Passing Minimum	:	- 50 marks

**Practical's**

University Examination (External)	:	60 marks
Internal Assessment	:	40 marks

**Calculation of Internal Assessment mark**

Attendance	:	05 marks
Number of Experiments/Exercise	:	10 marks
Practicle Test	:	10 marks
Geological Field work, Sample	:	
Display and Report	:	15 marks

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Total	:	40 marks
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Passing Minimum : Internal Assessment	:	50% - 20 marks
Passing Minimum : External Assessment	:	50% - 30 marks
Total Passing Minimum	:	- 50 marks

Everything should be supported by proper record separate passing minimum is necessary for Internal and External

**Question paper pattern**  
**Theory**

Time: 3 Hours

Max. marks : 75

Part - A :  $5 \times 5 = 25$   
(Answer all questions)  
(one question from each unit with either or type))

Part - B :  $5 \times 10 = 50$   
(Answer all questions)  
(one question from each unit with either or type))

**Practical**

Distribution of marks for practical

Experiment/ Exercise :	55 marks
Record :	5 marks
Total :	60 marks
Duration :	4 Hours

**Project**

Dissertation / Project :	150 marks
Viva - voce :	50 marks
Total :	200 marks

**SEMESTER- I**  
**CORE COURSE - I** **SUBJECT CODE: 18GEOC1**  
**GEOMORPHOLOGY AND GEODYNAMICS**

**Unit I**

Scope and application of Geomorphology – Geomorphic processes and their impact on various land forms – coastline, glacial, aeolian and fluvial and karst topography. Weathering - Erosion transportation, weathering products and soil profile and types.

**Unit II**

Geomorphology of Indian and Sub continents- Role of geomorphology in mineral, oil and groundwater exploration - Recent changes in Indian river courses and causes. Evolution of shorelines.

**Unit III**

Oceanic and continental features – Mid oceanic ridges, Gravity and magnetic anomalies at mid oceanic ridge- Trenches, Island Arcs - Eustatic changes and their causes, Ice ages - Concepts of Isostasy – views of Airy, Pratt, Hayford and Bowie and Arthur Holmes.

**Unit IV**

Earth – Brief review of recent theories about origin of solar system. -Interior of the Earth derived from seismo tectonics –Gravitational field of earth Earthquake mechanism – tsunami – Geomagnetism and Palaeo magnetism - Meteorites and other terrestrial materials.

**Unit V**

Geosynclines – Types and origin. Recent theories about continental drift and seismicity and plate movement – Geodynamics of the Indian Plate – Volcanism and Orogeny and epiorogeny –.Sub marine canyons and fans - Rift valleys and Ramp valleys.

### Books for Reference

1. Principles of Physical Geology  
Holmes.A, (1972) The English Language Book Society and Nelson
2. Physics and Geology  
Jacob.J, Russel, R.D & Wilson, J.T, (1959), McGraw – Hill, New York.
3. Introduction to Geophysics  
Howel,B.F
4. Dynamic Earth  
Wyllie., P.J, (1971), John Wiley & sons, New York.
5. Understanding the Earth  
Gass, I.G., Smith, P.S & Wilson, R.C.L., 2<sup>nd</sup>Edt., (1972), The English Language Books Society, London
6. Surface of the Earth  
Bloom.A.L. (1992) Prentice Hall India, New Delhi
7. Fluvial processes in Geomorphology  
Leopold,L.S, Wolman, K & Miller, J.P, (1970), Eurasia Publishing House Pvt Ltd., New Delhi.
8. Principles of Geomorphology  
William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
9. Physical Geology  
Leet, L.D & Judson.S, (1967), Prentice Hall, New York.
10. Planetary Engineering on Mars  
Sagan, C. (1973). , Icarus, 20, 513.
11. Mars: Evolution, Geology and Exploration  
Fairen, A.G.. Nova Publishers, ISBN: 978-1-62618-102-1



**PALAEONTOLOGY****Unit I****Evolution**

The origin of life – Millers experiment – Evolution – different theories of evolution – Lamarks theory of inheritance of acquired characters Recapitulation theory of Ernst Hackel (1811); Darwin's theory of Natural selection.

**Unit II**

Modern synthetic theory of Evolution, Mutation, Variation, Heredity, Isolation, Imperfections in Palaeontological Record. Brief account of Microevolution, Macroevolution and Megaevolution. Imperfections in Palaeontological record--The Pre- Cambrian fossils- Biodiversity and mass extinction events.

**Unit III****Invertebrates**

The classification, evolutionary trends and stratigraphic importance of Trilobites, Graptolites, Ammonites and Echinoidea. Uses of species and genera of echinodermata in biostratigraphic correlation.

**Unit IV****Vertebrates and Palaeobotany**

Evolution of Equidae, Proboscians and Man - Siwalik mammals and Gondwana flora - Brief account of Palynology- Statistical application in paleontology.

**Unit V****Micropalaeontology**

Field and Laboratory Techniques of Micropaleontology, Morphology of Ostracoda and foraminifera. Evolutionary trends of Foraminifera, Uses of species and genera of Foraminifera in biostratigraphic correlation - Uses of Microfossils.

### Books for Reference

1.	An Introduction to Palaeobotany	Arnold.R (1947), McGraw Hill, New York
2.	Organic evolution	Arumugam (1989), Sara Publication, Kanyakumari
3.	Invertebrate Palaeontology and evolution	Clarkson, E.N.K (1977) George Allen (1977) Unwin, London.
4.	The Evolution of Vertebrates	Colbert, E. (1955), John Wiley, New York.
5.	Palaeontology, Evolution and Animal Distribution	Jain, P.C &Anantharaman, M.S (1996), Vishal Publications
6.	Palaeontology – An Introduction	E.W. Nield& V.C. Tucker (1985), Pergamon Press, Oxford.
7.	The Vertebrate Story	Romer, A.S (1959), University of Chicago Press 4 <sup>th</sup> Edt. Chicago
8.	Principles of Invertebrate Palaeontology	Sherock, R.R &Twenohofel, W.H (1953), New York
9.	Invertebrate fossils	Moore, R.C, Lalicker, C.G & Fisher (1952), McGraw Hill, New York.
10.	Outlines of Palaeontology	Swannerton, H.H (1961), Edward Arnold Publ. Ltd., London.
11	Introduction to Microfossil	Jones Harper & Brothers, Publ. New York.

**ADVANCED CRYSTALLOGRAPHY AND OPTICAL MINERALOGY****Unit I**

Derivation of 32 crystal classes – Hermann Mauguin notation-symmetry projection – stereographic and Gnomonic projection of crystals belonging to normal classes. Twinning – irregularities of crystals.

**Unit II**

Calculation of crystal elements making use of Tangent relation, Anharmonic ratio, Napier's theorem and equation of the normal, 14 Bravais space lattices and derivation of 230 space group, X-ray powder method, Bragg's Law- and determination of cell edges and volumes.

**Unit III**

Isotropic crystal: optical properties of isotropic and anisotropic crystals – RI, Double refraction, Birefringence, sign of elongation, interference figure, 2V, pleochroic scheme and Determination of fast and slow Vibration directions-accessory plates- Uniaxial crystals- Uniaxial indicatrix- Examination of Uniaxial crystals under polarized light-Uniaxial interference figures - positive and negative Uniaxial crystals – Dichroism – determination of refractive indices of Uniaxial crystals.

**Unit IV**

The Fresnel's ellipsoid - Fletcher's indicatrix - Primary and secondary optic axes, Interior and exterior conical refraction, optic axial angle; Biaxial crystals in polarized light, Biaxial interference figure - positive and negative biaxial crystals; Dispersion in biaxial crystals - determination of refractive indices of Biaxial crystals.

**Unit V**

Optical anomalies – Outlines of U-stage methods of determination of optic axial angle, Anorthite content and twin laws of plagioclase feldspars, and orientation of cleavages and twin planes.

### Books for Reference

- |    |   |   |
|----|---|---|
| 1  | Powder method in X- ray                               | Azaroff. V.L. and Buerger. M.J. (1958)                                      |
| 2  | Elementary crystallography                            | Buerger. M.J (1956), New York.  |
| 3  | Dana's Manual of Mineralogy                           | Hurlbut. C.C (1961), New York.  |
| 4  | Optical Mineralogy                                    | Kerr. P.F (1959), McGraw Hill, Tokyo.                                       |
| 5  | Axes Universal Stage                                  | Naidu P.R.J (1958) Mineralogical Society of India, Madras.                  |
| 6  | Optical Crystallography                               | Wahlstrom.E.F (1960), Wiley, New York.                                      |
| 7  | Elements of Optical Mineralogy                        | Winchell. A.N (1967), Wiley Eastern Limited, New Delhi.                     |
| 8  | An Introduction to methods of Optical Crystallography | Bloss.F.D. New York.  |
| 9  | A Text book of Mineralogy                             | E.S. Dana, (2000) CBS Publishers & Distributors, New Delhi.                 |
| 10 | Mineralogy  | Dexter Perkins (2002), Prentice – Hall of India pvt. Ltd., New Delhi.       |
| 11 | Mineralogy  | Berry, Mason & Dietrich (1985), CBS Publishers and distributors, New Delhi. |

**REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM  
(GIS)****Unit I**

Remote sensing: Introduction – Principles of remote sensing: Aerial Photography – Types of Aerial Photographs – Vertical photographs and oblique photographs. Geometric characteristics of aerial photographs – photogrammetry: elementary mathematical concepts – tilt, swing, scale of photographs.

**Unit II**

Stereoscopy – stereoscopic vision, Pocket lens and mirror stereoscope – measurement of height and slope – Aerial mosaics; definition – difference between map and mosaic – different kinds of mosaics and their compilation. Interpretation of aerial photographs as applied to Geology.

**Unit III**

Recognizing elements of aerial photographs – tone, texture, size, shape and pattern – preparation of geological, geomorphological and structural maps – applications of aerial photographs for groundwater exploration – Space research in India-Bhaskara and IRS systems and their applications-Electromagnetic spectrum.Interaction of Electromagnetic energy with earth surfacial features.

**Unit IV**

Remote sensing platform for sensors: Balloons, Helicopters Aircrafts and satellites - Remote space; Multispectral photographic system – radiometers – scanners – multispectral scanners (MSS) – Thermal infra – red scanners – side looking airborne radar (SLAR)-Indian and foreign satellites- image interpretations for geological studies.

**Unit V**

Geographical Information System: Definition - Components and Scope of GIS - Spatial and Attribute Data - Data analysis – Integration and overlay analysis. Applications of GIS in various geological studies - Decision support system - Different GIS Software packages.

## Books for Reference

- |    |  |   |
|----|--|---|
| 1. | An Introduction to Geographical Information Systems              | Ian Heywood, Sarah Cornelius and Steve Carver Parson, (2003) (Edn) Singapore. |
| 2. | Text Book of Remote Sensing and Geographical Information Systems | M. Anji Reddy, (2001), BS Publication, Hyderabad .                            |
| 3. | Remote Sensing & Geographical Information System                 | A.M Chandra & S.K. Ghosh (2006), Narosa Publishing House, Chennai.            |
| 4. | Aerial Photographic Interpretation                               | Lueder, D.R. (1959): McGraw Hill, New York.                                   |
| 5. | Photo Geology  | Miller, C (1961):, McGraw Hill, New York                                      |
| 6. | Remote Sensing   | Sabins,F.F (1978):, W.H, Free Man, San Francisco                              |
| 7. | Remote Sensing and Image Interpretation                          | Lillesand, Thomas Kiefes (1979), John Wiley and sons                          |
| 8. | Principles & Applications of Photo geology                       | Shiv.N.Pandey (1987), Wiley Eastern Ltd., New Delhi.                          |

## SEMESTER II

CORE COURSE- IV

SUBJECT CODE: 18GEOC4

### MINERALOGY

#### Unit I

Classification of minerals- Structural and chemical principles of Minerals-,chemical bonds, ionic radii-,coordination numbers and polyhedran- Silicate structures – Isomorphism – Polymorphism – structural, physical, optical and chemical properties of the following groups and their geneses: - quartz,

#### Unit II

Structural, physical, optical, chemical and genetic characteristics of the feldspar, feldspathoids, pyroxene and amphiboles.

#### Unit III

Structural, physical, optical, chemical and genetic characteristics of the following groups: - olivine, mica, chlorite, epidote and scapolite.

#### Unit IV

Structural, physical, optical, chemical and genetic characteristics of the following Group.: -zeolite - clay minerals – garnet .

#### Unit V

Structural, physical, optical, chemical and genetic characteristics of the following minerals: - apatite, fluorite, tourmaline, beryl, topaz, sphene, spinel, cordierite, staurolite, andalusite, sillimanite, kyanite and wollastonite.

#### Books for Reference

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|----|--|---|
| 1. | An Introduction to Rock Forming Minerals | Deer.W.A.,Howie.R.A. &Zussmen.J. (1962), Longman, London. |
| 2. | Dana's Manual of Mineralogy              | Hurlbut.C.C, (1961), New York                             |
| 3. | Optical Mineralogy                       | Kerr.P.F. (1959), McGraw Hill, Tokyo.                     |
| 4. | Mineralogy                               | Berry Mason, (2004), CBS Publishers, New Delhi.           |
| 5. | Principles of Geochemistry               | Brian Mason, (1966), Wiley & Sons, New York.              |

**STRUCTURAL GEOLOGY****Unit I**

Mechanical aspects: Differential forces –analysis of stress –stress ellipsoid – stress – strain diagram – deformation – three stages of deformation – homogeneous and inhomogeneous deformation – factors controlling the behavior of materials – mechanics of plastic deformation.

**Unit II**

Primary structures: Primary structures and their uses in identification of top and bottom of strata- igneous structures (extrusive and intrusive). Emplacement of large plutons: time of emplacement – methods of emplacement. Folds: classification of folds according to Turner and Weiss (1963) and Ramsay (1967) – mechanics and causes of folding. Super posed folding.

**Unit III**

Foliations: cleavage and schistosity – their relation to major structures. Lineation: description of different lineations and their relation to major structures. Impact structures: description – origin. Diapers: nature – composition – evolution and origin. Tectonoites and their significance. Shear zone:types, Geometry and products of shear zone - Shear zone indicator.

**Unit IV**

Joints: Classification of Joints – origin – representation of joints on a stereogram. Faults: Classification of Faults – over thrust, nappe, klippe, graben, horst, transform faults – recognition of faults in field by different criteria – Mechanics and cause of faulting.

**Unit V**

Unconformity: kinds of Unconformity and Basement cover relation – their recognition in the field. Structural Petrology: Fabric – preparation of fabric diagrams – fabric symmetry – correlation of fabric symmetry with movement symmetry- various states of stress and their representation by mohr circle.



## Books for Reference

- |     |   |   |
|-----|---|---|
| 1.  | Structural Geology  | Billing. M.P. (1974), Prentice Hall, New Delhi.                           |
| 2.  | An outline of structural Geology  | Hobbs, B.E., Means, W.D. and Williams, P.F. (1976), John Wiley, New York. |
| 3.  | Structural and Tectonic Principles                                      | Badgley.P.C. (1965), Harper International, New York.                      |
| 4.  | Basic Problems of Geotectonics  | Belousov.V.V. (1962), McGraw Hill, New York.                              |
| 5.  | Structural Geology  | De Sitter. L.U. (1956), McGraw Hill, New York.                            |
| 6.  | Elements of Structural Geology  | Hill. E.S. (1972), John Wiley, New York                                   |
| 7.  | Geological Maps   | C.W. Chiplonkar& K.B. Power, (1988), DastaneRamchandra& Co., Pune.        |
| 8.  | The Techniques of Modern Structural Geology: Vol I – Strain Analysis    | Ramsay.J.G&Huber.M.I, (1983)  |
| 9.  | The Techniques of Modern Structural Geology: Vol II – Folds & Fractures | Ramsay.J.G&Huber.M.I, (1987)  |
| 11. | Structural Analysis of Metamorphic Tectonites                           | Turner.F.J&Weiss.L.E, (1963), McGraw – Hill, New York.                    |

**STRATIGRAPHY****Unit I****Principles of Stratigraphy**

Stratigraphy Principles – order of superposition. Identification of strata by fossils. Correlation – Different methods of correlation. Contemporaneous and Homotaxial formation. Magneto-stratigraphy, Chromo-stratigraphy and event Stratigraphy. Sequence Stratigraphy: Parasequence Sets and Stacking Patterns – Depositional Sequence- Sequence Boundary, Transgressive Surface, Maximum Flooding surface. Application to outcrops.

**Indian Stratigraphy****Unit II**

Stratigraphy and mineral riches of Dharwar Supergroup of Karnataka, Cuddapah Supergroup of Andhra Pradesh and Vindhyan system.

**Unit III**

Age of Saline series. Permo-Carboniferous of Salt range and Spiti, Climate, Sedimentation, Stratigraphy and Economic importance of Gondwana Supergroup.

**Unit IV**

Triassic of Spiti, Jurassic of Kutch. Cretaceous of Tamil Nadu. Cretaceous – Eocene boundary problem.

**Unit V**

Age of Deccan trap – Lameta beds - Changes at the end of Cretaceous and at the beginning of Tertiary - Siwalik system and Karewa series.

**Books for Reference**

- |    |   |   |
|----|---|---|
| 1. | The Geology of India and Burma                                | Krishnan, M.S (1968) C.B.S Publication & Distribution |
| 2. | Geology of India  | Wadia, D.N (1966) ELBS Tata McGraw Hill               |
| 3. | Fundamentals of Historical Geology and Stratigraphy of India. | Ravindrakumar (1985), Wiley Eastern Ltd, New Delhi.   |

**FUEL GEOLOGY****Unit I****Coal Geology**

Coal Petrology: Origin of Coal; Classification and optical properties of macerals and microlithotypes. Techniques and methods of coal microscopy. Application of coal petrology. Classification of coal in terms of Rank, Grade and Type. Indian classification for coking and non-coking coals. International classifications (I.S.O. and Alpern's classification).

**Unit II**

Coal as a source rock in petroleum generation. Coal exploration and estimation of coal reserves. Indian coal reserves and production of coal in India. Coalbed methane – a new energy resource. Elementary idea about generation of methane in coal beds, coal as a reservoir and coal bed methane exploration.

**Unit III****Petroleum Geology**

Petroleum – its composition and Properties;. Origin (formation of Source rock Kerogen, organic maturation and thermal cracking of kerogen) and migration of petroleum. Reservoir rocks-porosity and permeability. Reservoir traps – structural, stratigraphic and combination traps. Oil field fluids – water, oil and gas.

**Unit IV**

Methods of prospecting for oil and gas (geological modeling); Elementary knowledge of drilling and logging procedures - Oil shale - An outline of oil belts of the world. Onshore and offshore petroliferous basins of India. Oil policy of India. Gas Hydrates: Exposure to gas hydrates and future prospective.

**Unit V****Atomic Energy**

Concept of atomic energy. Radioactive minerals. Mode of occurrence and association of atomic minerals in nature. Methods of exploration for atomic minerals. Productive geological horizons of atomic minerals in India, **Geothermal energy**: Principles of utilization of Earth's heat. Types of geothermal source-Applications, exploration, distribution of geothermal energy. Geothermal sources in India.-Future scenario.

### **Books for Reference**

1. Chandra, D., Singh, R.M. Singh, M.P., 2000: Textbook of Coal (Indian context). Tara Book Agency, Varanasi.
2. Singh, M.P. (Ed.) 1998: Coal and organic Petrology. Hindustan Publishing Corporation, New Delhi.
3. Scott, A.C., 1987: Coal and Coal-bearing strata: Recent Advances. The geological Society of London, Publication no. 32, Blackwell scientific Publications.
4. Stach, E., Mackowsky, M-Th., Taylor, G.H., Chandra, D., Teichmüller, M. and Teichmüller R., 1982: Stach Textbook of Coal petrology. Gebrüder Borntraeger, Stuttgart.
5. Holson, G.D. and Tiratso, E.N., 1985: Introduction to Petroleum Geology. Gulf Publishing, Houston, Texas.
6. Tissot, B.P. and Welte, D.H., 1984: Petroleum Formation and Occurrence, Springer – Verlag.
7. North, F.K., 1985: Petroleum Geology. Allen Unwin.
8. Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press.
9. Durrance, E.M. 1986: Radioactivity in Geology-principles and application. Ellis Horwood.
10. Dahlkamp, F.J., 1993: Uranium Ore Deposits. Springer Verlag.
11. VBoyle, R.W., 1982: Geochemical prospecting for Thorium and Uranium deposits, Elsevier

**NATURAL HAZARDS, MITIGATION AND MANAGEMENT****Unit I**

Natural Hazard – definition -Earth's processes: catastrophic geological hazards: study of floods, tsunamis, Landslides, Earthquakes, Volcanism and avalanches – with a view to assess the magnitude of the problem, prediction and perception of the hazards. Laws and regulations towards hazard management.

**Unit II**

Earthquakes-Definition –focus -epicenter-seismic waves-intensity and magnitude-Richter scales – Tsunami -Seismograph- seismogram-seismicity in Indian region - Seismic gaps - mitigation measures and management. Preparation of seismic hazard map.-Seismic Gap.

**Unit III**

Volcanoes-Definition-structure - types –Global distribution - mitigation measures and management.Avalanche – Definition – types – mitigation.Flood- Definition - causes - vulnerable zones in India-Mitigation measures and management.Coastal erosion – its causes-mitigation measures and management.

**Unit IV**

Landslides- types -slow flowage, rapid flowage, sliding and subsidence – causes and mechanism - Vulnerable zones in India - mitigation measures and management. Deforestation and land degradation-Cyclone- Definition -causes - vulnerable zones in India-mitigation measures and management.

**Unit V**

Mass movement – factor influencing slope stability – types of mass movement – hazards of mass movement – strategies for their reduction and the role of geology. Soil erosion – Soil formation – soil classification – factor influencing soil erosion – hazards of soil erosion – Drought – types, mitigation measures.

**Books for Reference**

1. Geology, environment, Society K.S.Valdiya (2004) Universities Press (India) Private limited, Hyderabad,India
2. Coping with natural hazards: Indian context K.S.Valdiya (2004) Orient Longman Private limited, Hyderabad,India.
3. Engineering and general geology Parbin Singh (2003) S.K.Kataria and sons Delhi India
4. Genaral Geology V.Radhakrishnan (1996) V.V.P.Publishers, Tuticorin,India
5. Lundgren (1986). Environment Geology, rentice Hall Publishers, New Jersey.

**PRACTICAL – I CRYSTALLOGRAPHY, MINERALOGY AND FIELD  
WORK I****Unit I**

Stereographic and Gnomonic projections of natural crystals of normal classes; Symmetry projection of 32 classes; calculation of crystal elements to test the knowledge of the application of tangent relation, anharmonic ratio, Napier's theorem and equation of the Normal.

**Unit II**

Microscopic study of the optical properties of important rock forming minerals; Megascopic study of important minerals.

**Unit III**

Determination of dichroic and pleochroic schemes; Determination of extinction angle; Optic orientation, Identification of pinacoidal sections of amphiboles and pyroxenes; optic orientation. Determination of the sign of elongation; Determination of the optic sign of uniaxial and biaxial minerals; determination of birefringence; Determination of the optic axial angle by Mallard's method.

**Unit IV**

Determination of the following by U – stage methods - Optic axial angle; Anorthite content and twin laws in plagioclase feldspars and optic orientation in other minerals.

**Unit V**

Mineral calculations for the following group of minerals – feldspars, pyroxenes, amphiboles, olivine, micas and garnets.

**FIELD WORK I**

In partial fulfilment of the M.Sc Geology degree course, the students should be taken to areas of geological importance for a period of 8 to 10 days, for learning geological mapping. They should present the collected specimens along with their thin sections and submit a report on the field training at the time of the Main Practical Examination.

**STRUCTURAL GEOLOGY, REMOTE SENSING AND PALAEOLOGY****Unit I**

Study and interpretation of geological maps showing fold, fault, unconformities and igneous intrusions.

**Unit II**

Solving structural Geology problems – relating to dip of bed and width of outcrop; relating to fold and faults – preparation of pi and diagrams& their interpretations.

**Unit III**

Remote sensing –preparation of geomorphological, geological and structural maps from aerial photographs; interpretation of satellite imageries for geological features.

**Unit IV**

Identification of Microfossils – Nummulites, Textularia, Globigerina, Globotruncana, Spiroloculina, Siphonia, and Ventriculites.

Study of Fossiliferous rocks – shell limestone, crinoidal limestone, calc-tufa. Reconstruction of fossils, Evolutionary trends observed in the fossils of the following groups; Trilobites, Ammonoidea and Graptozoa.

**Unit V**

Molluscs: Lamellibranchia – Meretrix, Arca, Cardita, Venus, Pecten, Unio, Modiola, Lima, Inoceramas, Alectryonia, Gryphea, Exogyra, Spondylus, Radiolites, Trigonina, Ostrea.

Gastropods – Turritella, Turbo, Trochus, Cerethium, Natica, Conus, Fusus, Physa, Voluta, Murex, Bellerophon, Helix, Cypraea, Euomphalus.

Cephalopods – Nautilus, Ceratite, Orthoceras, Turritulites, Goniatite, Acanthoceras, Baculites, Belemnites.

**Arthropods**

Trilobites; Paradoxides, Phacops, Calymene, Olenus, Olenellus.

Corals – Halysites, Favosites, Thecosmilia, Calceola, Zaphrentis, Lithostrotion.

Echinodermata – Cidarid, Holaster, Hemiaster, Micraster, Encrinurus, Marsupites, Stigmatopodus.

Brachiopods – Atrypa, Terebratulina, Athyris, Orthis, Spirifer, Rhynchonella, Pentamerous, Productus.

Graptolites – Monograptus, Diplograptus, didymograptus, Tetragraptus.

Plant fossil – Ptillophyllum, glossopteris, Calamites, Elatocladus, Lepidodendron, Sigillaria, Stigmaria, Otozomites, Gondwanadium.

Visit to a nearby geological organizations.

**IGNEOUS PETROLOGY**

**Unit I**

Classification of Igneous rocks – Principles involved in the classification – Shand & Holmes, C.I.P.W. and Streckeisen's classification. Major and trace elements and isotopic composition of igneous rocks. Igneous rock types of pre-orogenic and early orogenic activity, syn-orogenic activity and post-orogenic activity

**Unit II**

Concept of experimental petrology. Study of phase rule as applied to silicate systems; binary systems, (a) Forsterite – Fayalite, (b) Leucite – Silica and (c) Nepheline – Silica. Study of ternary systems (a) Anorthite – Forsterite – Silica (b) Forsterite – Diopside – Silica and (c) Nepheline – Kaliophyllite – Silica system. Bowen's reaction principle.

**Unit III**

Study of the crystallization of the basaltic magma; and granitic magma; role of fugitive constituents in the magma; diversity of igneous rocks – Differentiation, assimilation; Magma mixing. Variation diagrams.

**Unit IV**

Petrography, classification and origin of important rocks such as alkaline rocks, ultramafic rock association, anorthosites, kimberlites, carbonatites, Ophiolites, lamprophyres, Pegmatites and their volcanic equivalents.

**Unit V**

Magmas their generation in crust and mantle, their emplacement and their relation to plate tectonics. Petrogenetic provinces : Continental areas: Volcanic-Flood basalts-Tholeiites (Deccan Trap, Columbia River basalts); Layered gabbroic intrusions: The Bushveld complex, Skaergaard intrusion, Still water complex. Plutonic: Carbonatites and alkaline rock complexes of India; Oceanic Rift valleys: MORB- Tholeiites – Ophiolites



### Books for Reference

1. Theoretical Petrology, Barth, T.F.W. (1962), New York.
2. The origin of Igneous Rocks Bowen, N.L (1928), Princeton.
3. Petrography of the Igneous and Metamorphic rocks of India Chatterjee, S.C (1974), Macmillan.
4. Petrology of Igneous and Metamorphic rocks Hyndman,D.W (1985), McGraw Hill Publishers, New York.
5. Igneous and Metamorphic rocks Turner.F.J and Verhoogen.J, (1966), New York.
6. Petrography William, H., Turner, F.J., & Gilbert, C.M, (1954), Vakils, Feffer& Simons Pvt Ltd., Bombay.
7. Ultramafic and related rocks Wyllie,P.J (1967).
8. Igneous Petrology Carmichael.I.S.E,Turner.F.J and Verhoogen.J, (1974), McGraw – Hill, New York.
9. Igneous Petrology Bose,M.K, (1997), The World Press Pvt Ltd., Calcutta.
10. Petrology for Students Nockolds,S.R., Knox O.B., Chinner,G.A (1979),Cambridge University Press.
11. Petrology Haung. T.,(1962) McGraw Hill Pvt.Ltd., New York.
12. Igneous Petrology Alexander R. McBirney, 2<sup>nd</sup>Edti., (1993), CBS Publishers and Distributors, New Delhi.

**SEDIMENTARY AND METAMORPHIC PETROLOGY****Sedimentary Petrology****Unit-I**

Texture of Sediments and Sedimentary Rocks – size-concept of size, shape and roundness, porosity and permeability. Textures of non-clastic sediments – Sedimentary Structures and their importance - The mechanical, chemical and biological structures of sedimentary rocks – Classification of Sedimentary Rocks- Clastics and carbonate rocks

**Unit II**

Provenance of Sediments and Sedimentary Rocks- Petrology of Clastic Rocks- Conglomerates, Sandstones and Mudstones- Heavy Minerals Analysis and its significance- Stability of heavy minerals-Lithification and diagenesis.

**Unit III**

Petrology of Non-clastic Rocks- Limestones and Dolomites- Phosphatic sediments and Phosphorites- Volcanic clastic Sediments-Environmental analysis: Parameters and classification – Sedimentation and tectonics-Modern classification of sedimentary basin (plate tectonics context) Indian sedimentary basin and classification.

**Metamorphic Petrology**

Chemical principle of metamorphism, phase rule, Brief study of metamorphic zones, grades and facies.

**Unit IV**

Classification of metamorphic rocks – ACF and AKF diagrams – textures and structures of metamorphic rocks – Fabric, crystalloblastic fabric and crystalloblastic series, preferred orientation.

**Unit V**

Metamorphic diffusion and differentiation –paired metamorphic belts- Metasomatism – petrography and petrogenesis of migmatites, amphibolites, charnockites and eclogites.

## Books for Reference

1. Sedimentary Rocks  
Pettijohn, F.J. (1984), 3<sup>rd</sup> edition, CBS Publishers & Distributors, New Delhi.
2. Manual of Sedimentary Petrography  
Krumbein, W.C. & Pettijohn, F.J. (1938), Plenum, New York.
3. Sedimentary Petrography  
Miller, H.B. (1962), Vol. I & II, MacMillan, New York.
4. Petrography  
William, H., Turner, F.J., & Gilbert, C.M. (1954), San Francisco
5. Introduction to Sedimentology  
Sengupta, S.M. (2007), CBS Publishers & Distributors, New Delhi.
6. Metamorphism  
Harker, A (1950), Methuen, London
7. Metamorphism and Metamorphic belts  
Miyashiro, A (1973), John Wiley and Sons, New York
8. Metamorphic Petrology  
Turner, F.J (1968), McGraw Hill, New York
9. Igneous and Metamorphic Petrology  
Turner, F.J & Verhoogen, J (1960), McGraw Hill, New York.
10. Petrology of Metamorphic Rocks  
Roger Mason, (1984), CBS Publishers & Distributors, New Delhi
11. Petrogenesis of Metamorphic rocks  
Winkler, H.G.F, (1979), 5<sup>th</sup> Ed. Springer Verlag, New York.
12. Petrologic Phase Equilibria  
Ernst, W.G, (1976), W.H. Freeman & Co, USA.
13. Metamorphic Petrology  
Bhaskar Rao, 1986, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

**MAJOR ELECTIVE- III**

**SUBJECT CODE: 18GEOE3**

## **HYDROGEOLOGY**

### **Unit I**

Hydrologic cycle, subsurface movement and vertical distribution of ground water. Classification of aquifer, concepts of drainage and groundwater basin. Rainfall and its analysis; Runoff assessment.

### **Unit II**

Theory of ground water flow, Darcy's law, its Validity and application, determination of permeability in the laboratory and in the field. Well hydraulics, data analysis and interpretation.

### **Unit III**

Rock properties affecting groundwater, Geologic controls of groundwater. Groundwater levels and fluctuations; various causes of fluctuations. Fresh and salt water relationship in coastal areas. Groundwater Assessment.

### **Unit IV**

Groundwater provinces of India. Investigation of groundwater by surface and subsurface methods- Field procedure Inverse slope and Curve matching methods. Types of wells, drilling methods, construction and design, development and maintenance of wells

### **Unit V**

Water quality criteria for different uses, Graphical presentation of water quality data – bar, pie and Piper's trilinear diagrams. Groundwater pollution. Artificial recharge and rainwater harvesting

### **Books for Reference**

- |  |   |
|--|---|
| 1. Groundwater Hydrology                             | Todd.D.K. (1980), John Wiley Sons, Inc.                                   |
| 2. Groundwater Drilling                              | Handa.O.P (1984), Oxford & I.B.H. Publishing Co.                          |
| 3. Groundwater                                       | Raghunath.H.M. (1987), 2 <sup>nd</sup> Edition, Wiley Eastern Ltd.        |
| 4. Groundwater Assessment Development and Management | Karanth.K.R. (1987). Tata McGraw Hill Publishing Company, Ltd.            |
| 5. Groundwater                                       | Tolman.C. (1972), McGraw Hill Book Company.                               |
| 6. Modern Hydrology                                  | Kazmann, (1973), Harper and sons Publishers, New Delhi.                   |
| 7. Hydrogeology                                      | Davis.S.N. and Dewiest.R.J.M (1966), John Willey and Sons, Inc, New York. |
| 8. Groundwater Resource Evaluation                   | Walton.W.C. (1970). McGraw Hill Book Company.                             |

**ENVIRONMENTAL GEOLOGY****Unit I**

Introduction to Environmental Sciences- Earth Energy systems – matter, Energy - types of Energy systems – Energy, work, power, order and disorder – Entropy – Man's impact on energy systems. Atmosphere and green house effects- Earth's thermal environment and climates. Global warming-. Ozone depletion.

**Unit II**

Concepts of ecosystem. Earth's major ecosystems terrestrial and aquatic Forms of energy – short account of various energy systems. Conventional and non conventional source. Petroleum, Natural gas, hydroelectric power, nuclear, coal, solar and wind energy-Ice sheets and fluctuation of sea level. Ocean pollution by toxic wastes.

**Unit III**

Air Pollution, sources of pollution, pollution due to dust and waste disposal. National and International standards; Noise levels- national standards, mining machinery, ill effects. Air sampling techniques – Respirable dust samplers, high volume air samplers, personal sampling pumps, weather monitoring equipments, automatic recorders. Introduction to Environmental Magnetism.

**Unit IV**

Regulating mining activities – Environmental impact of mining (Open cast & under ground mining), mineral processing and smelting. Restoring mined lands. Solid waste disposal – geology in planning and site selection for land fills. Radio active waste disposal and management. Environmental health hazards – Medical geology principles, trace elements and health – causes and effects of elemental intake. Health hazard due to excess usage of fertilizers and pesticides.

**Unit V**

Elements of Environmental Impact Assessment – impacts, primary, secondary, prediction, assessment, base-line data generation, physical, biological, cultural, socioeconomic aspects. Carrying capacity based developmental planning – Assimilative capacity – supportive capacity – Resource based planning – Institutional strategies. Sustainable Developmental Planning - Environmental Legislations.

## Books for Reference

- |    |   |   |
|----|---|---|
| 1. | Environmental Geology   | Carla W. Montgomery WCH Wm.C (1989). Brown Publishers Dubuque, Iowa                             |
| 2. | Environmental Geosciences: Interaction between Natural System and Man | Arthur N. Strahler & Alan H. Strahler, (1973) Hamilton Publishing Co, Santa Barbara, California |
| 3. | Geology, Environment and Society                                      | K.S. Valdiya, (2004) University Pres (India) Pvt Ltd., Himayatnagar, Hyderabad                  |
| 4. | A Text book in Environmental Science                                  | V.Subramanian, (2002) Narosa Publishing House, New Delhi  |
| 5. | Advances in Environmental Science (Vol I & II)                        | Metaclaf, R.L.Potts, N (Jr), John Wiley & Sons inc., New York.                                  |
| 6. | Man's Impact on Environment   | Detwler, T.R, (1971) McGraw Hill.   |
| 7. | Man's Role in Changing Face of the Earth                              | Thomas, W.L, (1956), University of Chicago Press.   |

**MARINE GEOLOGY AND QUATERNARY GEOLOGY****Unit I**

Morphologic and tectonic domains of the ocean floor, structure composition and mechanism of the formation of Ocean crust, hydrothermal vents: Ocean margins and their significance -Ocean circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino.

**Unit II**

Indian ocean Dipole Thermohaline circulation oceanic conveyor belt. Formation of bottom waters; major water masses of the world's oceans. Oceanic sediments: Factors controlling the deposition and distribution of ocean sediments, diagenetic changes on oxic and anoxic environments.

**Unit III**

Tectonic evolution of the ocean basins. Mineral resources. Palaeoceanography – Approaches to Palaeo oceanographic reconstructions; various proxy indicators for Palaeo oceanographic interpretation.

**Unit IV**

Sea level processes and sea level changes. Methods of palaeo Sea Surface temperature Quantifications. Reconstruction of monsoon variability by using marine proxy records opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic.

**Unit V**

Definition of Quaternary. Quaternary Stratigraphy – Oxygen isotope stratigraphy, biostratigraphy and magneto stratigraphy. Quaternary climates – glacial-interglacial cycles, eustatic changes, proxy indicators of palaeo environmental/paleo climatic changes, - land, ocean and cryosphere (ice core studies). Responses of geomorphic systems to climate, sea level.

**Books for Reference**

1. Kuenen, Ph. H. 1950 Marine Geology, Wiley.
2. Shepard, F.P., 1973 Submarine Geology, Harper and Row.
3. Kennett, J.P. (1982). Marine Geology. Prentice Hall. New Jersey.
4. Shepard, F.P. (1977). Geological Oceanography. Crane Russak. New York.
5. Holmes, A. & P.L. Duff. (1996). Principles of Physical Geology, 4th revised Edition, ELBS, London
6. Radhakrishnan, V. (1996). General Geology, V.V.P. Publishers, Tuticorin.
7. Emiliani, C. (1992). Planet Earth, Cambridge University Press, Delhi.
8. Porter, S.C. & B.J. Skinner J. (1995). The Dynamic Earth, John Wiley & Sons, New York.
9. Seibold, E. & W.H. Berger. (1993). The Sea Floor. Springer. Delhi.
10. Weisberg, C.P. (1979). Oceanography. McGraw Hill. New York.

## **SEMESTER- IV**

**CORE COURSE - IX**

**SUBJECT CODE: 18GEOC9**

### **ECONOMIC GEOLOGY AND MINERAL ECONOMICS**

#### **Unit I**

Classification of ore deposits, Controls of ore localization, Metallogenic epochs and provinces, Micro textures of ore, Paragenesis and Zoning. Geologic thermometry - Wall rock alterations.

#### **Unit II**

Study of the following metallic and non-metallic minerals with reference to their mineralogy, mode of occurrence, distribution in India and origin:-Iron, Copper, gold, manganese,

#### **Unit III**

Study of the following metallic and non-metallic minerals with reference to their mineralogy, mode of occurrence, distribution in India and origin:Mica, lead and zinc, placer deposits, rare earth minerals.

#### **Unit IV**

Minerals used in industry :- glass, fertilizers, paint, ceramics, cement, abrasives, refractory and gemstones, their mineralogy, mode of occurrence and distribution in India and origin.

#### **Unit V**

Definition and scope, significance of minerals in national's economy, Tenor, grade and specifications for minerals.India's status in mineral production.Mines and minerals legislation of India.Strategic, Critical and essential minerals. Changing patterns of minerals consumption, Mineral concession rules, law of sea. Introduction to MMDR Act. Mineral conservation and substitution. National mineral policy and planning of mineral development.



### **Books for Reference**

1. Economic Mineral deposits A.N. Bateman,(1981), Asian Publishers House, New Delhi.
2. Petroleum Geology Levenson.A.I, (1980), CBS Publication, Madras.
3. Introduction to Economic Mineral Sharma, N.L & Ram, K.S.V (1964), Dhanbad Publishers Dhanbad.
4. Ore Deposits Park.C.P and Mac Diarmid.R.AV.H.Freeman's& Co San Francisco.
5. India's Mineral Resources Krishnaswamy.S, (1979), Oxford IBH New Delhi.
6. Mineral of India Meher,D.N. Wadia, (1994), National Book Trust, New Delhi.
7. Mineral Deposits Lindgren.W, (1928), McGraw Hill, New York.
8. Mineral Economics Sinha.R.K and Sharma.N.L.(1970) Oxford IBH Publishing Co., New Delhi.

**APPLIED GEOLOGY****Unit I**

Mineral Prospecting: Geological prospecting. Guide to mineral deposits: Physiographic guide - Stratigraphic guide –Mineralogical guide - Structural guide – Evaluation of ore bodies and their extension –Principle and types of Sampling.-Ore reserve estimation-An introduction to Geo Statistics.

**Unit II**

Open Cast Mining: Definition of following mining terms. Shaft, Adit, Stope, Tonnage, Tenor, Assay, Run off mine, Cut off grade and Tonnage factor, Mining methods – Alluvial mining methods / Placer mining, open cast mining methods / surface mining. Underground Mining: Underground mining methods.

**Unit III**

Ore dressing: Principles and scope of mineral dressing; Physical and chemical properties of minerals as applied to mineral dressing. Size reduction Fundamentals – Preliminary breaking –Size separation –Screening –Sieve scale, Grizzlies , Vibrating screens;- Settling- Principles of settling, gravity concentration;- Jigs;- Rakes Classifiers; - shaking tables – Wilfley tables – principles of magnetic separation and Electrostatic separation; - Flootation – Definition, principle and application.

**Unit IV**

Geological, Geochemical and Geophysical exploration methods for oil and gas- techniques - Oil drilling methods: rotary drills, cable tool drill, diamond drill, direction of drill, off shore drilling technology, drilling fluids – mud, polymers and their properties.

**Unit V**

Engineering Geology: Role of Geologist in engineering geology projects – Engineering properties of rocks – laboratory and field tests – geological investigations for dams, reservoirs and tunnels, spillways, bridges, buildings, highways, airfield and underground caverns.Geotechnical case studies of major projects in India.

## Books for Reference

- |  |  |
|--|--|
| 1. Mineral Economics                     | Sinha.R.K&Sharma.N.L., (1988), Oxford & IBH Press, New Delhi.                  |
| 2. Courses in mining Geology             | Arockiasamy, R.N.P, (1995), Oxford & IBH Publishing Co. New Delhi.             |
| 3. Mining Geology                        | Mckinstry, H.E, (1952), Prentice Hall Pvt Ltd., New York.                      |
| 4. India's Mineral Wealth                | Coggin Brown, J and Day, A.K, (1995), Oxford Press, London.                    |
| 5. Ore deposits of India                 | Gokhale, K.V.G.K and Rao, T.G, Affiliated East – West Press (pvt) Ltd., Madas. |
| 6. Text Book of Mining Geology           | Umapthy.R.M, (2002), Dattsons, Nagpur.   |
| 7. Petroleum Geology Principles of       | Leverson.A.I, (1980), CBS Publication, Madras.                                 |
| 8. Engineering Geology and Geotechniques | Krynine, D.P and Judd, W.A, (1957), New York.                                  |
| 9. Engineering Geology &Geotechnics      | F.G.Bell, (2005), B.S. Publications, A.P.                                      |

**GEOPHYSICS, GEOCHEMISTRY AND GEOCHRONOLOGY****Unit I**

Geophysics and Geochemistry: Definition and Scope. Various geophysical methods: Gravity Method - Seismic Method – Electrical Method – Resistivity method - Magnetic Method. Earth mineralogy - Average mineralogical composition of crust, mantle- mineral transformations in the mantle with depth.

**Unit II**

Principles of geophysical exploration *Gravity Method*: Instruments, measurements, Corrections applied and interpretation of data. *Seismic Method* – Seismic wave propagation, recording instrument, refraction and reflection method. *Electrical Method* – Resistivity method, S.P. Method for mineral exploration. Interpretation of field data and application.

**Unit III**

Magnetic Method- *Magneto meter* – Vertical, Horizontal. Field procedure – data interpretation. Aeromagnetic method - Radioactive Method – Brief scope and application of instruments used. Well logging techniques and their application - Electro logging methods – Self potential (S.P) log- Resistivity log – induction log – gamma ray log – density log – porosity log – sonic log – dip meter log – caliper log – variable density log – temperature log.

**Unit IV****Geochemistry**

Principles of evolution of hydrosphere, biosphere and atmosphere. Geochemical classification and distribution of elements in the earth-Cosmic abundance of elements-Geochemical cycle-Primary dispersion and Secondary dispersion-Geochemical Prospecting - Background value, Threshold value, Path finder element - Geochemical anomaly-sampling, Geobotanical Indicators.

**Unit V****Geochronology**

Law of radio activity, Decay schemes and derivation of equations of age, Rb/Sr, U-Th-Pb methods of dating of rocks and its petrogenesis -Age of the Earth. Stable isotopes and their application to Earth's system Processes.

## Books for Reference

- |    |  |  |  |
|----|--|--|--|
| 1. | Geochemistry in Mineral<br>Exploration         |  | Rose,A.W., Hawkes, H.E, Webb,J.S., (1979),<br>Academic Press, London.                    |
| 2. | Introduction to<br>exploration<br>Geochemistry |  | Levinson,A.A, (1974), Applied Publication Co.,<br>Calgary.                               |
| 3. | Geophysics                                     |  | Nettleton  |
| 4. | Outlines of Geophysical<br>prospecting         |  | Ramachandra Rao, T.N, IBH Publishers, New<br>Delhi.                                      |
| 5. | Introduction to<br>Geophysical prospecting     |  | Milton B. Dobrin and Carl H. Savit (1960),<br>mcgrawHill International Edns., New Delhi. |
| 6. | Geophysical Exploration                        |  | Heiland, G.A.  |
| 7. | Geochemistry                                   |  | Goldschmidt, (1954), Oxford Publishers,<br>London.                                       |
| 8. | Principles of<br>Geochemistry                  |  | Brian Mason, (1985), John Wiley, New York.   |
| 9. | Principles of<br>Geochemistry                  |  | Mason, John Wiley, New York  |

**PETROLOGY AND FIELD WORK II****Unit I**

Study of orbicular, graphic, Rapakivi structures. Megascopic study of the following igneous rock types: granites, syenites, diorites, gabbro, norite, anorthosite, dunite, peridotite, pyroxenite, nepheline syenites, theralite, carbonatite, pegmatite, aplite, dolerite, rhyolite, trachyte, andesite, basalt, felsite, shonkinite, obsidian, pitchstone, pumice, scoria, vitrophyre, porphyritic varieties of granite, syenite, dolerite, granites of Closepet, Trichengodu, Sankari, Chamundi; syenites of Sivanmalai, Pikkili and Deccan Basalts.

**Unit II**

Megascopic study of the following sedimentary and metamorphic rock types: laterite, breccias, conglomerates, grit, arkose, clay, sandstones, shales, limestones, chert, flint, coal and its varieties. shell limestone of Trichy. Cuddapah limestone, Satyavedu sandstones, Sriperambudur shales, Neyveli Lignite. slates, schists, phyllites, gneisses, amphibolite, charnockite, granulites, hornfels, eclogite, quartzites, marbles, quartz magnetite rock, leptynite, Khondalite, Peninsular gneiss, cordierite, sillimanite gneiss of Ganguvarpatti, Pallavaram charnockite, Calc silicate rocks of Madukkarai, Nagari quartzite.

**Unit III**

Microscopic study of the rocks: Grain determination, Modal analysis, Petrographic study of the following igneous rock types: granites, syenites, diorites, gabbros, Norite, anorthosite, dunite, periodotite, pyroxenite, nepheline syenites, theralite, carbonatite, pegmatite, aplite, dolerite, rhyolite, trachyte, andesite, basalts, phonolite, felsite, shonkinite, obsidian, pitchstone, scoria, Porphyritic varieties of granite, syenite and dolerite,

**Unit IV**

Microscopic study of the following Sedimentary and Metamorphic rock types: laterite, breccia, conglomerates, grit, arkose, greywacke, clay, sandstones, shales, limestones, chert, flint. slate, schist, phyllite, gneisses, amphibolite, charnockite, granulites, hornfels, eclogite, quartzite, marble, leptynite.

## **UNIT V**

Petrochemical calculations: C.I.P.W. norm – Niggli Basis and NiggliVerte – Variation diagrams of Harker and Niggli – Addition and Subtraction diagrams. Graphical representation of Metamorphic mineral paragenesis – A.C.F. diagram; Mechanical Analysis and interpretation of sand samples.

## **FIELD WORK II**

In partial fulfillment of the M.Sc Geology degree course, the students should be taken to areas of geological importance for a period of 8 to 10 days, for rocks and mineral collections. They should present the collected specimens along with their thin sections and submit a report on the field work at the time of the Main Practical Examination.

**ECONOMIC GEOLOGY AND APPLIED GEOLOGY****Unit I**

Megascopic study of the following ore minerals: bauxite, chromite, franklinite, limonite, molybdenite, stibnite, willemite, zincite and zircon.

Ore minerals of copper, iron, lead and zinc, manganese, nickel, silver, tin and Radioactive minerals.

**Unit II**

Megascopic study of the following industrial minerals: asbestos, barite, graphite, gypsum, micas, ochres. Minerals used in the refractory industry - Minerals used as abrasives, Minerals used in cement, ceramic, fertilizer, glass, paint and pigment industries: Building Stones.

**Unit III**

Study of important ore textures. Estimation of ores: ferrous and ferric iron, copper, lead and calcium.

**Unit IV**

Sampling of ores and evaluation problems: Sampling at regular intervals.

**Unit V**

Sampling of ores and evaluation problems: Sampling at irregular spacings. Water analysis: - pH determination – determination of Specific Conductivity and Total Dissolved Solids.

*Visit to a nearby geological organization for a day or two.*