

THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. GEOLOGY

DEGREE COURSE

CBCS PATTERN

(With effect from 2017 - 2018)

The Course of Study and the Scheme of Examinations

S. No	Part	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER I									
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English	Paper-1	6	4	English	25	75	100
3	III	Core Theory	Paper-1	6	5	Geomorphology	25	75	100
4	III	Core Practical	Practical	3	0	Palaeontology	0	0	0
5	III	ALLIED -1	Paper-1	4	4	Chemistry I	25	75	100
6	III	Allied Practical	Practical-1	3	0	Chemistry I	0	0	0
7	IV	Environ. Studies		2	2	Environmental Studies	25	75	100
				30	19		125	375	500
SEMESTER II									
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English	Paper-2	4	4	English	25	75	100
10	III	Core Theory	Paper-2	6	5	Palaeontology	25	75	100
11	III	Core Practical	Practical-1	3	3	Palaeontology	25	75	100
12	III	ALLIED-1	Paper-2	4	4	Chemistry II	25	75	100
13	III	Allied Practical	Practical-1	3	2	Chemistry II	25	75	100
14	IV	Value Education		2	2	Value Education	25	75	100
15	IV	Soft Skill		2	1	Soft Skill	25	75	100
				30	25		200	600	800

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SEMESTER III						CIA	Uni. Exam	Total	
16	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
17	II	English	Paper-3	6	4	English	25	75	100
18	III	Core Theory	Paper-3	3	3	Structural Geology	25	75	100
19	III	Core Practical	Practical-2	3	0	Structural Geology	0	0	0
20	III	ALLIED-2	Paper-3	4	4	Physics I	25	75	100
21	III	Allied Practical	Practical-2	3	0	Physics I	0	0	0
22	IV	Skill based Subject	Paper-1	3	3	Engineering Geology	25	75	100
23	IV	Non-major elective	Paper-1	2	2	Disaster Management	25	75	100
				30	20		150	450	600
SEMESTER IV						CIA	Uni. Exam	Total	
24	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
25	II	English	Paper-4	6	4	English	25	75	100
26	III	Core Theory	Paper-4	3	3	Stratigraphy	25	75	100
27		Core Practical	Practical-2	3	3	Structural Geology and Surveying	25	75	100
28	III	ALLIED-2	Paper-4	4	4	Physics II	25	75	100
29	III	Allied Practical-2	Practical-2	3	2	Physics II	25	75	100
30	IV	Skill based Subject	Paper-2	3	3	Remote sensing	25	75	100
31	IV	Non-major elective	Paper-2	2	2	Environmental Geology	25	75	100
				30	25		200	600	800
SEMESTER V						CIA	Uni. Exam	Total	
32	III	Core Theory	Paper-5	6	5	Crystallography	25	75	100
33	III	Core Theory	Paper-6	6	5	Mineralogy	25	75	100
34	III	Core Theory	Paper-7	6	5	Economic Geology	25	75	100
35	III	Core Practical	Practical-3	3	0	Crystallography and Mineralogy	0	0	0

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36	III	Core Practical	Practical-4	3	0	Petrology and Economic Geology	0	0	0
37	III	Elective	Paper-1	3	3	Mining Geology	25	75	100
38	IV	Skill based Subject	Paper-3	3	3	Gemology	25	75	100
				30	21		125	375	500
SEMESTER VI							CIA	Uni. Exam	Total
39	III	Core Theory	Paper-8	5	5	Igneous Petrology	25	75	100
40	III	Core Theory	Paper-9	5	5	Sedimentary and metamorphic Petrology	25	75	100
41	III	Core Theory	Paper-10	5	4	Hydrogeology	25	75	100
42	III	Core Practical	Practical-3	3	3	Crystallography and Mineralogy	25	75	100
43	III	Core Practical	Practical-4	3	3	Petrology and Economic Geology	25	75	100
44	III	Elective	Paper-2	3	3	Geographical Information System	25	75	100
45	III	Elective	Paper-3	3	3	Marine Geology	25	75	100
46	IV	Skill based Subject	Paper-4	3	3	Mineral Exploration	25	75	100
47	V	Extension Activities		0	1		100	0	100
				30	30		300	600	900

B.Sc. Geology: Syllabus (CBCS)

Part	Subject	Papers	Credit	Total credits	Marks	Total marks
Part I	Languages	4	4	16	100	400
Part II	English	4	4	16	100	400
Part III	Allied (Odd Sem)	2	4	8	100	200
	Allied (Even Sem)	2	4	8	100	200
	Allied –Prac (Even Sem)	2	2	4	100	200
	Electives	3	3	9	100	300
	Core	10	(3-7)	45	100	1000
	Core Practical	4	3	12	100	400
Part IV	Env. Science	1	2	2	100	100
	Soft skill)	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others/NME	2	2	4	100	200
	Skill Based	4	3	12	100	400
Part V	Extension	1	1	1	100	100
	Total	41		140		4100

I.LIST OF LANGUAGES COURSES

- :Paper-1 Tamil/Other Languages
- :Paper-2 Tamil/Other Languages
- :Paper-3 Tamil/Other Languages
- :Paper-4 Tamil/Other Languages

II.LIST OF FOUNDATION COURSES

- :Paper-1 English
- :Paper-2 English
- :Paper-3 English
- :Paper-4 English

III.LIST OF CORE COURSES

- :Paper-1 Geomorphology
- :Paper-2 Palaeontology
- :Paper-3 Structural Geology
- :Paper-4 Stratigraphy
- :Paper-5 Crystallography
- :Paper-6 Mineralogy
- :Paper-7 Economic Geology
- :Paper-8 Igneous Petrology
- :Paper-9 Sedimentary and Metamorphic Petrology
- :Paper-10 Hydrogeology

IV. LIST OF CORE PRACTICALS

- : Practical -1 Palaeontology
- : Practical -2 Structural Geology and Surveying
- : Practical -3 Crystallography and Mineralogy
- : Practical -4 Petrology and Economic Geology

V.LIST OF ALLIED THEORY SUBJECTS

- :Paper-1 Chemistry
- :Paper-2 Chemistry
- :Paper-1 Physics
- :Paper-2 Physics

VI.LIST OF ALLIED PRACTICALS

- : Practical -1 Chemistry
- : Practical -2 Physics

VII.LIST OF SKILL BASED SUBJECT

- :Paper-1 Engineering Geology
- :Paper-2 Remote Sensing
- :Paper-3 Gemology
- :Paper-4 Mineral Exploration

VIII.LIST OF ELECTIVES COURSES

- :Paper-1 Mining Geology
- :Paper-2 Geographical Information System
- :Paper-3 Marine Geology

IX.LIST OF NON-MAJOR ELECTIVES COURSES

: Paper-1 Disaster Management
:Paper-2 Environmental Geology

X.LIST OF COMPULSARY COURSES

: Environmental Studies
: Value Education
: Extension Activities

Question Paper Pattern

Time: 3 Hours
75

Max Marks:

Part-A (10X2=20 Marks)

Answer all the questions

Each Answer shall be in about 30 words.

Part-B (5X5=25 Marks)

Answer all the questions with internal choice

Each Answer shall be in about 300 words.

Part-B (3X10=30 Marks)

Answer any three out of five

Each Answer shall be in about 1000 words.

THIRUVALLUVAR UNIVERSITY

B.Sc. GEOLOGY

SYLLABUS

CBCS PATTERN

(With effect from 2012-2013)

SEMESTER I

PAPER - 1

GEOMORPHOLOGY

Objective:

To familiarise about the basic principles of Geology, Evolution of geomorphic concepts, tectonics, Erosional and Depositional landforms, Earth's various exogenetic processes like weathering and action of geological agents and Endogenetic processes like earthquake, volcanoes, tectonic process and mountains.

Unit I

Definition of Geomorphology. Evolution of geomorphic concepts. Principles/laws of geomorphology. Endogenic and exogenic driving forces. Resisting forces. Dynamic equilibrium of driving and resisting forces and Threshold. Modern concepts, quantitative geomorphology and process geomorphology.

Unit II

Role of tectonics, climate, slope, lithology, vegetation, land cover/land use and human in landscape evolution. Spatio-temporal scale of geomorphic processes. Mineral stability series. Physical, chemical and biological weathering. Soil profiles, Types of soils. Erosional and Depositional landforms. Agents of geomorphic processes – Volcanism, Gravity, glaciers, wind, rivers, tides, waves, currents.

Unit III

Classification of mountains, Types of volcanoes. Volcanic landforms. Isostasy, Tectonic landforms, Gravity land forms. Climate zones of the World. Genesis, distribution and types of glaciers. Land forms in glaciated regions. Aeolian process as a geomorphic agent. Aeolian land forms. Characteristics of dry and wet deserts.

Unit IV

Overland and subsurface flow. Fluvial process. Types of drainage pattern. Fluvial landforms. Types of Deltas. Classification of coast lines, Depositional and erosional coast lines. Coastal and marine landforms.

Unit V

Geomorphic sub-divisions of Indian sub-continent – Himalayan landscape, Indo Gangetic plains, Deccan Plateau, Coastal low lands. Application of Geomorphology in groundwater exploration, environmental and natural resource management. Geomorphic mapping methods and tools.

TEXT / REFERENCES BOOKS

1. Richard Huggett. (2007) Fundamentals of Geomorphology. II Edition. Routledge N. Y.
2. Ritter, D.F., Kochel, R.C., Miller, J.R., (2002) Process Geomorphology, Waveland press.
3. H.S. Sharma (1990). Indian Geomorphology. Concept Pub. Co., New Delhi.
4. Robert, S.A. and Suzanne, P.A., (2010) Geomorphology – The mechanics and chemistry of landscapes. Cambridge University Press.
5. Thornbury, W.D., (2004) Principles of Geomorphology. II edition. Wiley Eastern Ltd. New Delhi.

ALLIED – 1

CHEMISTRY – I

OBJECTIVE:

- Basic knowledge on Metallurgy, Cycloalkanes, Polarising Effects, Stereochemistry, Chemical Kinetics, Catalysis, Photochemistry, VSEPR Theory, Fuels, Osmosis, Nuclear Chemistry, Petroleum Chemistry, Chemistry of Naphthalene, Conductors and Applications wherever necessary are to be taught for I- Semester.

UNIT – I

1.1 General Metallurgy - Extraction of Metals - Minerals and Ores- Difference between Minerals and Ores – Minerals of Iron, Aluminum and Copper - Ore Dressing or Concentration of Ores - Types of Ore Dressing- Froth Floatation process, Gravity separation and Magnetic separation.

1.2 Calcination, Smelting, Roasting, Flux, Slag - Definition - Reduction methods - Goldschmidt Aluminothermic process and Carbon Reduction method - Refining of Metals - Electrolytic, Van Arkel and Zone Refining.

1.3 Ores of Titanium and Cobalt - Extraction of Titanium and Cobalt.

UNIT – II

2.1 Cycloalkanes - Preparation – Wurtz reaction and Dieckmann's condensation - Properties of Cycloalkanes – Substitution and Ring opening reactions.

2.2 Polarisation - Inductive effect, Mesomeric effect and Steric effect (Acid and Base Strength).

2.3 Stereoisomerism – Types - Cause of Optical Activity – Enantiomers - Diastereomers - Meso form - Optical Activity of Lactic acid and Tartaric acid - Racemisation and Resolution – Definition and Methods - Geometrical isomerism – Definition and example - Maleic and Fumaric acid – Differences.

UNIT – III

3.1 Chemical Kinetics – Rate of a reaction – Definition of Order and Molecularity – Distinction between Order and Molecularity - Derivation of First order rate equation - Half Life Period of first order reaction.

3.2 Catalysis - Catalyst - Autocatalyst - Enzyme catalyst - Promoters - Catalytic poisons – Active Centre - Differences between Homogeneous and Heterogeneous Catalysis - Industrial Applications of Catalysts.

3.3 Photochemistry – Grothus-Draper's law – Stark-Einstein's law - Quantum yield – Photosynthesis - Phosphorescence – Fluorescence.

UNIT – IV

4.1 VSEPR Theory – Hybridisation and Shapes of simple molecules BF_3 , PCl_5 , SF_6 and XeF_6 .

4.2 Fuels – Classification of Fuels - Calorific value of Fuels – Water gas, Carbureted Water gas and Producer gas – Composition and Uses - Non-Conventional fuels - Need of Solar Energy - Applications - Biofuels – Oil gas, Natural gas and LPG – Uses.

4.3 Osmosis - Osmotic pressure - Reverse osmosis – Definition - Desalination of Sea water.

UNIT – V

5.1 Nuclear Chemistry – Atomic number, Mass number - Isotopes, Isobars and Isotones – Definition and Examples - Definition of Half life period - Nuclear Binding Energy, Mass Defect and N/P ratio - Nuclear Fission and Nuclear Fusion (Elementary idea) - Applications of Radioisotopes in Medicine, Agriculture and Industries – Carbon Dating.

5.2 Crude Oil - Petroleum - Petroleum Refining - Cracking - Applications of Cracking – Naphthalene – Preparation – Haworth's method – Properties – Oxidation, Reduction and Uses of Naphthalene - Structure of Naphthalene (Structural elucidation not necessary).

5.3 Conductors, Insulators, Semiconductors, N- and P- Type Semiconductors – Definitions and Examples.

**SEMESTER II
PAPER - 2
PALAEOONTOLOGY**

Objective:

To study about the Palaeo life in the world, Habitats of animals, indicators of evolution and migration of life forms, General morphology and classification of fossil belonging to phylum Arthropoda, Mollusca, Brachiopoda, protozoa, plant fossils and Applications of Micro palaeontology

Unit I

Definition of Palaeontology – organic world- Animal Kingdom – classification of animals – Habitats and Habits of animals. Definition of fossils – nature and modes of preservation of fossils: Body fossils and; Unaltered hard parts, Altered hard parts : Petrification , permineralisation , carbonisation, recrystallisation, silicification; trace fossils- mould, casts, tracks , trails, borings; Uses of fossils – stratigraphic indicators – climatic indicators- indicators of palaeogeography – indicators of evolution and migration of life forms – indicators of new deposits of coal and petroleum – life through ages.

Unit II

Phylum Arthropoda:- Class – Trilobita- General morphology : classification – geological history. Phylum Porifera – A short account of sponges. Phylum coelentrata – class Anthozoa – zoological features – General morphology : classification – tabulate corals – Rugose corals geological distribution – stratigraphic importance. Sub phylum Hemichordata – class Graptozoa: order Dendroidea and Graptoloidea – general morphology, classification , geological distribution and stratigraphic importance.

Unit III

Phylum Mollusca: Class Pelecypoda - General characters – ornamentation , classification , geological history. Class Gastropoda:- General morphology , shell forms – types of coiling – Dextral and sinistral – ornamentation , classification and geological history. Class Cephalopoda:- General morphology , (Nautilitic , Goniotitic , Ceratitic and Ammonitic) – shell forms – ornamentation – classification, geological history- morphology of a Belemnite shell.

Unit IV

Phylum Brachiopoda:- General morphology – Brachial skeleton – morphometric details, ornamentation , classification , geological history. Phylum Echinodermata: Class Echinoidea: General morphology, corona (Ambulacra, inter

ambulacra) – peristome – regular and irregular echinoids – classification– geological history. Class Crinoidea:- General morphology , classification, geological history. Class Blastoidea: General morphology.

Unit V

Phylum protozoa – Order,; Foraminifera: General morphology – dimorphism – classification , geological history and stratigraphic importance. Class Crustacea:- Sub class: Ostracoda – morphology – classification and geological history. A brief outline of the classification of vertebrates. A short account of Devonian fishes, Mesozoic Reptiles, Siwalik mammals. General classification of plant kingdom – plant fossils from India – A brief account of the following plant fossils :- Glossopteris , Gangamopteris , Ptilophyllum , Calamites , Lepidodendron and Sigillaria. Applications of Micro palaeontology

TEXT BOOKS

1. Henry woods: Invertebrate palaeontology – Cambridge.
2. Romer , A.S.: Vertebrate palaeontology, Chicago press.
3. Arnold, C.A., : An introduction to Palaeobotany., MC-Graw Hill.
4. B.U. Hag and A. Boersma (1978) : Introduction to marine Micropalaeontology. Elsevier, Netherlands
5. Jain, P.C., and Anatharaman, M.S.: An introduction to Paleontology, Vishal Publications.

REFERENCE BOOKS

1. Raup, D.M. and Stanley, M.S.: Principles of Palaeontology, CBS Publishers.
2. Moore , R.C., Laliker , C.G.& Fisher, A.G.: Invertebrate Fossils , Harper brothers
3. Shrock. R.R. and Twenhofel , W.H – 1953 : Principles of invertebrate Palaeontology, Arnold publication Easton - Invertebrate Paleontology

**CORE PRACTICAL I
PALAEONTOLOGY**

Megascopic identification and description of the following fossils:- Corals: Calceola, Zaphrentis, Favosites, Halysites,; Brachiopoda: Spirifer, Productus, Terebratula, Rhynchonella, Atrypa, Athyris, Orthis, Echinodermata: Pentrimites, Cidaris, Hemicidaris, Micraster, Holaster, Hemiaster, Stygmatothyris, Mollusca: Pelecypoda: - Arca, Cardium, Meretrix, Cardita, Pecten, Trigonina, Megalodon, Pholodomya, Gryphea, Exogyra, Ostrea, Inoceramus, Alectryonia. Gasteropoda:- Natica, Turbo, Trochus, Turritella, Cerethium, Conus, Voluta, Murex, Fusus, Physa, Bellerophon. Cephalopoda:-Nautilus, Goniatites, Ceratites, Acanthoceras, Scholenbachia, Perispinctus, Hamites, Scaphites, Baculites, Turritites and Belemnites, Arthropoda: Trilobita:- Paradoxides, Calymene, Phacops. Trinucleus, Graptolites: - Phyllograptus, Tetragraptus, Didymograptus, Diplograptus, Monograptus, Plant fossils:- Glossopteris, Gangamopteris, Ptillophyllum, Lepidodendron, Sigillaria and Calamites.

MICRO FOSSILS:-

Lagena, Nodosaria, Textularia, Operculina, Elphidium, Ammonia.

DIAGRAMS:-

Paradoxides, Pentremites, Trigonina, Arca, Meretrix, Murex, Turritella, Nautilus, Spirifer.

**ALLIED
CHEMISTRY – II**

OBJECTIVE:

- Basic knowledge on Coordination Chemistry, Industrial Chemistry, Carbohydrates, Aminoacids, Proteins, Electrochemistry, Paints and Pigments, dyes, Vitamins, Medicinal Chemistry, Corrosion and Applications wherever necessary are to be taught for II- semester.

UNIT – I

1.1 Coordination Chemistry - Nomenclature of Coordination Compounds - Ligands, Central Metal Ion and Complex Ion – Definition and Examples – Coordination Number - Werner’s Theory of Coordination Compounds - Chelates - Functions and Structure of Haemoglobin and Chlorophyll.

1.2 Industrial Chemistry - Fertilisers and Manures – Biofertilisers - Organic Manures and their importance - Role of NPK in plants - Preparation and Uses of Urea, Ammonium Nitrate, Potassium Nitrite and Super Phosphate of Lime.

1.3 Contents in Match Sticks and Match Box - Industrial making of Safety Matches – Preparation and Uses of Chloroform, DDT, Gammexane and Freons.

UNIT – II

2.1 Carbohydrates - Definition and Examples - Classification – Oxidation and Reduction Reactions of Glucose - Structure of Glucose (Structural elucidation not necessary) - Uses of Starch - Uses of Cellulose Nitrate and Cellulose Acetate.

2.2 Amino Acids – Definition and Examples - Classification of Amino Acids - Preparation - Gabriel Phthalimide Synthesis – Properties – zwitterion and Isoelectric point - Structure of Glycine.

2.3 Proteins – Definition - Classification of Proteins based on Physical properties and Biological functions - Primary and Secondary Structure of Proteins (Elementary Treatment only) – Composition of RNA and DNA and their Biological role - Tanning of Leather - Alum (Aluminum chloride tanning) - Vegetable tanning – Chrome Tanning.

UNIT – III

3.1 Electrochemistry - Electrolytes – Definition and Examples – Classification - Specific and Equivalent Conductance - their determination – Variation of Specific and Equivalent conductance with Dilution – Ostwald’s Dilution Law and its Limitations.

3.2 Kohlrausch's Law - Determination of Dissociation Constant of weak Electrolytes using Conductance measurement - Conductometric titrations.

3.3 pH – Definition and pH determination by indicator method - Buffer solutions - Buffer action - Importance of buffers in the living systems.

UNIT – IV

4.1 Paints - Components of Paint – Requisites of a Good Paint - Pigments – Classification of Pigments on the basis of Colour – Examples - Dyes – Definition – Chromophores and Auxochromes – Examples - Colour and Dyes - Classification based on Constitution and Application – Examples.

4.2 Vitamins – Definition – Classification – Water Soluble and Fat Soluble – Occurrence - Biological Activities and Deficiency Diseases caused by Vitamin A, B, C, D, E and K - Hormones – Definition and Examples – Biological Functions of Insulin and Adrenaline.

4.3 Chromatography - Principles and Applications of Column and Paper chromatography- R_f value.

UNIT – V

5.1 Drugs - Sulpha Drugs – Preparation and Uses of Sulphapyridine and Sulphadiazine - Mode of Action of Sulpha Drugs - Antibiotics - Uses of Penicillin, Chloramphenicol and Streptomycin - Drug Abuse and Their Implication - Alcohol – LSD.

5.2 Anaesthetics - General and Local Anaesthetics - Antiseptics - Examples and their Applications - Definition and One Example each for Analgesics, Antipyretics, Tranquilizers, Sedatives - Causes, Symptoms and Treatment of Diabetes, Cancer and AIDS.

5.3 Electrochemical Corrosion and its Prevention – Electroplating – Applications.

ALLIED PRACTICAL – 1
CHEMISTRY

VOLUMETRIC ANALYSIS

1. Estimation of HCl – Standard sulphuric acid.
2. Estimation of Borax - Standard Sodium Carbonate.
3. Estimation of NaOH – Standard Oxalic Acid.
4. Estimation of FeSO₄ – Standard FAS.
5. Estimation of Oxalic acid – Standard FeSO₄.
6. Estimation of FAS – Standard Oxalic Acid.
7. Estimation of Oxalic acid – Standard Oxalic Acid.
8. Estimation of Fe²⁺ using Diphenylamine / N- Phenyl Anthranilic acid as indicator.

ORGANIC ANALYSIS

Systematic Analysis of Organic Compounds containing One Functional Group and Characterisation by Confirmatory Tests.

Reactions of Aromatic Aldehyde, Carbohydrates, Mono and Dicarboxylic acids, Phenol, Aromatic Primary Amine, Amide and Diamide.

REFERENCE BOOKS

- ❖ Inorganic Chemistry - P. L. Soni - Sultan Chand (2006).
- ❖ Inorganic Chemistry - B. R.. Puri, L. R. Sharma and K. C. Kallia – Milestone Publications (2013).
- ❖ Selected Topics in Inorganic Chemistry - W. U. Malik, G. D. Tuli and R. D. Madan - S. Chand Publications (2008).
- ❖ Text Book of Inorganic Chemistry – R. Gopalan, Universities Press – 2012.
- ❖ Text Book of Organic Chemistry - P. L. Soni - Sultan Chand & Sons - 2007.
- ❖ Advanced Organic Chemistry - Bahl and Arun Bahl - Sultan Chand and Co. Ltd – 2012.

- ❖ Organic Reaction Mechanisms - Gurdeep Chatwal- Himalaya Publishing House.
- ❖ A Text Book of Organic Chemistry K. S. Tewari, N. K. Vishol, S. N. Mehrotra-Vikas Publishing House – 2011.
- ❖ Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishal Publishing Company – 2013.
- ❖ Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N. Dash - Sultan Chand & Co – 2006.
- ❖ Understanding chemistry – C. N. R. Rao, Universities Press – 2011.

SEMESTER III
PAPER - 3
STRUCTURAL GEOLOGY

Objective:

To know about the Topographic , Geological maps and its applications, Primary and secondary structures, geometry and elements of fold, fault and joint surface recognition in the field, Foliation Mechanism and Uses of compass in field.

Unit I

Scope and Aim of Structural Geology – Methods of representing physiographic features - Contours – Topographic and Geological maps, their preparation and uses. Physical properties of rocks: Deformation – brittleness, plastic and elastic properties. Beds and their attitudes – Dip and strike – Trends of outcrop - Relation between true and apparent dips. Width of outcrops, True thickness, vertical thickness and their mutual relations.

Unit II

Primary and secondary structures – primary structures of extrusive and intrusive igneous rocks – primary structures of sedimentary rocks. Plutons – concordant and discordant plutons – dyke, sill, phacolith, lopolith, batholiths, ring dykes and cone sheets – brief study of salt domes.

Unit III

Folds – geometry and elements of folded surface – classification – descriptive study of different types of folds – recognition of folds in the field and on map. Unconformities – definition – types – significance – recognition in the field and on map – over lap and off lap; Inlier and Outlier.

Unit IV

Faults – definition – terminology – genetic and geometric classification and description – recognition of faults in the field and on the map – distinction between faults and unconformities – a short account of rift valleys. Joints – definition – geometric and genetic – classification – descriptive study – application of joints.

Unit V

Foliation – Primary and secondary foliations; Cleavage and Schistosity – Types and Origin of Rock Cleavages. Lineation – Kinds and Origin of lineation; Mechanism and Uses of Clinometer and Brunton compass, GPS and their uses in geological mapping.

TEXT BOOKS

1. Billings, M. P. Structural Geology: Prentice Hall, Englewood Cliffs, U.S.A.
2. Novin, C. M. Principles of structural Geology John Willey, New York.
3. Gokhale, N. W. : Theory of Structural Geology. CBS Publishers.

REFERENCE BOOKS

1. V.V. Belousov-Structural Geology, Moscow
2. P.C. Bedgley-Structural and Tectonic, Principles: Harper & Row, New York.
3. E.W. Spencer-An Introduction to structural Geology: Mc GrawHill, New York.
4. Park, P.G.-Fundamentals of structural Geology, John Willey & sons,

ALLIED – 2

PHYSICS - I

UNIT – I: PROPERTIES OF MATTER

Elasticity : Hooke's Law – Elastic Constants – bending of beam – Bending moment – Cantilever Depression at the loaded end of a cantilever – determination of Young's modulus by non-uniform bending.

Torsion : Torsion couple – Potential energy in a twisted wire – Torsional pendulum – Time period – Determination of rigidity modulus by Torsional oscillation (without masses).

Viscosity: Viscosity of a liquid – Viscous force – Co-efficient of viscosity of a liquid – Poiseuille's formula .

Surface Tension: Surface Tension – Surface Tension and interfacial surface tension by the method of drops.

UNIT – II: HEAT

Heat: Specific heat – Newton's law of cooling – determination of specific heat of a liquid using Newton's law of cooling – Emissivity and Emissive Power.

Low Temperature: J.K. Effect – Positive Effect – Negative Effect – Temperature of Inversion – Super conductors. Type I and II – Meisner Effect – Helium I and II.

UNIT – III: ELECTRICITY AND MAGNETISM

Electricity: Potentiometer – Principle – Calibration of low range voltmeter – Measurement of internal resistance of cell – measurement of an unknown resistance.

Magnetism – Moment and pole strength of a magnet – Deflection magnetometer – Tan C position – Vibration magnetometer – Theory – Period of Oscillation – Determination of M and B_H using the deflection magnetometer in Tan C position and the vibration magnetometer.

UNIT – IV: SOUND AND ACOUSTICS OF BUILDING

Sound: Transverse vibration of strings – Velocity and frequency of vibrations of a stretched string – laws – sonometer – A.C. Frequency – Steel Wire – Brass wire.

Ultrasonics – Production by Piezo – electric method – properties and uses.

Acoustics of buildings: Reverberation – Reverberation time – Sabine's formula (definition only) – Sound absorption co-efficient of surface – conditions for the perfect acoustics.

UNIT – V: OPTICS

Interference: Air Wedge – Description – Test for optical flatness of glass plate – Determination of diameter of a thin wire by air wedge.

Diffraction: Theory of transmission grating – Normal Incidence – Determination of Wavelength of monochromatic source and Wavelength of mercury line using a grating by normal Incidence.

Fibre optics: principle-classification of optical fibres-fibre optic communication system block diagram.

Books for Study & Reference

1. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
5. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
6. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
7. Modern Physics – R. Murugesan S. Chand & Co. (2004).
8. Introduction to Fibre optics- K.Thyagarajan and Ajay Ghatak,Cambridge,University Press(1999).

SKILL BASED SUBJECT
PAPER – 1
ENGINEERING GEOLOGY

Objective:

To familiarise about the scope of Engineering Geology, properties of rocks, selection of reservoir sites, Tunnels and Foundation of geological investigations, and ground water problems.

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.

Unit III

Reservoirs: definition, selection of reservoir sites, and groundwater conditions. Problems in reservoirs: sedimentation, slope control, leakage and seismicity. Short account of Indian reservoirs.

Unit IV

Tunnels: definition, parts of a tunnel, types, tunnelling in hard and soft rocks, geological investigations, and groundwater conditions.

Unit V

Foundations: definition, geological investigations, and ground water problems. Outline of support structures: rods, bolts, anchors, arches, rings, linings, and retaining walls.

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.

**NON-MAJOR ELECTIVE
PAPER - 1
DISASTER MANAGEMENT**

Objective:

To understand about Natural disasters, monitoring and disaster management measures for Earthquake, Landslide, Volcanoes and Tsunamis

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 earthquakes. 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.

REFERENCE 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. 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. 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. Miller, T.G. (2004). Environmental Science. Wadsworth Publishing. USA.

**SEMESTER IV
PAPER - 4
STRATIGRAPHY**

Objective:

To know about the Principles of stratigraphy in Geological record of India, economic importance of Cuddapah, Vindhyan, Gondwana and Tiruchirapalli formations.

Unit I

Principles of stratigraphy: law of order of superposition. law of uniformitarianism and law of faunal succession. Correlation: fossiliferous and unfossiliferous rocks. Standard stratigraphic scale and Indian Geologic Time scale. Imperfections in Geological record. Geological divisions. Stratigraphic classification and Nomenclature. Stratigraphic Units: Homotaxis. Physiographic divisions of India: Peninsular India, Indogangetic alluvial plains, Extra Peninsular India

Unit II

Precambrian Stratigraphy: Archaeans of Dharwar Province, Archaeans of Eastern Ghat - The Sausar and Sakoli Series, Archaeans of Singhbhum – Iron Ore Series and Gangpur Series. Archaeans of Tamilnadu, Mineral Wealth of Archaeans of India, The Eparchaeon Unconformity, Stratigraphy and Mineral Wealth of Cuddapahs, Stratigraphy and Mineral Wealth of Vindhyan, Kurnool group, Life during Precambrian

Unit III

Paleozoic Stratigraphy: Distribution of Paleozoic rocks in India, Cambrian of Salt Range, Age of Saline Series, Upper Carboniferous and Permian rocks of Salt Range, Paleozoic rocks of Kashmir Valley, Paleozoic rocks of Spiti Valley, Paleozoic rocks of Peninsular India,

Unit IV

Mesozoic Stratigraphy: The Depositional Environment-distribution-life-classification and economic importance of Gondwana formations of India, Coastal Gondwana of India, Gondwana formations of Tamilnadu, Triassic of Spiti – The Lilang System, Jurassic of Kutch, Cretaceous of Tiruchirapalli – Pondicherry – Bagh Beds, Deccan traps : distribution , structure , Lameta beds – infratrappean and intertrappean beds, age of the Deccan traps.

Unit V

Cenozoic Stratigraphy: Comprehensive account of the geological events took place during Cenozoic era in India, rise of Himalayas, stratigraphy of Siwalik system, fauna and flora of Siwaliks, Tertiary rocks of Assam, Karewa formation, Tertiary rocks of Tamilnadu, Tertiary rocks of Kerala, Pleistocene Glaciation - Mineral wealth of Tertiary rocks of India:

TEXTBOOKS

1. Krishnan M.S. (2003) - Geology of India and Burma, 6th Edition, CBS.
2. Wadia D.N. (1953)– Geology of India, TATA McGraw – Hill.
3. Ravindrakumar K.R.- Stratigraphy of India.
4. Lemon R.Y (1990)- Principles of Stratigraphy, Merrill Publishing Co.

REFERENCE BOOKS

1. Pascoe, E.H.(1968) - A manual of the Geology India and Burma, Govt of India Publications.
2. Gregory , J.W. and Barret B.H- General stratigraphy Mathuen.

**CORE PRACTICAL-2
STRUCTURAL GEOLOGY AND SURVEYING**

Structural Geology:

Contour maps and their interpretation. Exercises to predict trends of the outcrop of Horizontal, vertical and incline beds with respect to topography – reading of solid conformable maps – deciphering dip and strike of outcrops – construction of map when three points over a bedding plane are given construction of vertical sections order of super – position – vertical thickness of formations.

Reading of solid fold and fault maps construction of vertical sections – Determination of throw of vertical faults. Reading of unconformable solid maps – construction of sections. Reading of solid maps of areas when more than one structure is involved – determination of comparative ages of structures and intrusions – geological history.

Structural Problems – problems relating to true dip and apparent dip; Determination of vertical and true thickness.

Description of features in Survey of India's (SOI) toposheet: Extramarginal, marginal, intramarginal information, major conventional signs and symbols, physical and socio-cultural features

SURVEYING

Chain survey – prismatic compass survey – plane table survey – leveling. Clinometer Compass and Brunton Compass:-To find out dip and strike of the beds. GPS:- Fundamentals and applications.

ALLIED – 4

PHYSICS II

UNIT – I: WAVE MECHANICS

Wave Mechanics – De Broglie Waves – Dual Nature – Experimental Study of Matter Waves – Davission and Germer's Experiment – G.P. Thomson's Experiment – Heisenberg's uncertainty Principle – The position and moment of a particle.

UNIT – II : NUCLEAR PHYSICS

Particle accelerators – cyclotron, particle detectors – GM Counter Artificial Transmutation – Rutherford's Experiment – The Q value equation for nuclear reaction – Threshold energy – Nuclear Reactions.

Conservation Laws: Conservation of Charge – Conservation of Nucleons – Conservation of Mass – Energy – Conservation of Parity – Quantities conserved and quantities not conserved in a nuclear reaction.

UNIT – III : ENERGY PHYSICS

Sources of conventional energy – Need for non-conventional energy resources – solar energy utilization – solar water heater – solar drier – conversion of light into electrical energy – solar cell – merits and demerits of solar energy – wind energy – its conversion systems – energy from Bio mass – Bio gas generation – Industrial and space application.

UNIT – IV: CRYSTALLOGRAPHY

Crystallography : The crystal structure – Unit Cell – Bravais lattice- structures of simple cubic-BCC and FCC- coordination number, packing factor calculation for the above structures – Hexagonal closed packed(HCP) structure -Miller indices – concept of Reciprocal Vectors.

UNIT – V: ELECTRONICS

Electronics: Transistor characteristics in common base and common emitter mode- Transistor single stage amplifier- Expression for input impedance, output impedance and current gain.

Digital Electronics : NAND and NOR as universal building blocks- De Morgan's theorem –statement and proof- Fabrication of diodes and transistors using Monolithic technology–limitations.

Books for Study & Reference

1. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
5. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
6. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
7. Modern Physics – R. Murugesan S. Chand & Co. (2004).
8. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
9. Introduction to Solid State Physics – C. Kittel, 5th Edition Wiley Eastern Ltd.
10. Renewable & Sustainable energy sources – Agarwal.

ALLIED PRACTICAL – 2

PHYSICS

(Any 15 Experiments)

1. Young's modulus – non uniform bending – pin and microscope.
2. Rigidity modulus – Static Torsion Method Using Scale and Telescope.
3. Rigidity modulus – Torsional oscillation method (without symmetric masses).
4. Determination of Co-efficient of Viscosity – Graduated Burette.
5. Surface Tension and Interfacial Tension – By drop weight method.
6. Specific Heat Capacity of a liquid – by Newton's Law of Cooling.
7. Sonometer – Determining A.C. Frequency. (Screw Gauge is given).
8. Sonometer – frequency of tuning fork.
9. Newton's Rings – Radius of Curvature.
10. Air Wedge – Determination of thickness of thin wire.
11. Spectrometer Grating – Minimum Deviation – Mercury Lines.
12. Spectrometer – Refractive Index of a liquid – Hollow Prism.
13. Potentiometer – Calibration of High Range Ammeter.
14. Potentiometer – Calibration of Low Range Voltmeter.
15. Determination of M and B_H using Deflection Magnetometer in Tan C position and vibration magnetometer.
16. Figure of merit and voltage sensitiveness of table galvanometer.
17. Construction of AND, OR gates using diodes and NOT by transistors.
18. Zener diode – Voltage Regulation.
19. NAND / NOR as universal gate.
20. Demorgan's theorem verification.

**SKILL BASED SUBJECT
PAPER - 2
REMOTE SENSING**

Objective:

To understand about the Basic principles of Remote Sensing, Aerial remote sensing, optical remote sensing, Thermal Remote Sensing and application 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. Groundwater 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. 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.

NON-MAJOR ELECTIVE

PAPER - 2

ENVIRONMENTAL GEOLOGY

Objective:

To know about the basic concepts of environmental Geology, Causes, effects, strategies for their mitigation, Natural Hazards and Coastal processes.

Unit I

Environmental Geology : Earth's place in space. Fundamentals concepts of Environmental Geology: Human Population Growth - Sustainability - Earth as a System - Hazardous Earth Processes - Scientific Knowledge and Values. Internal Structure of Earth and Plate Tectonics - Plate Tectonics & Environmental Geology. Minerals and Rocks. Ecology and Geology.

Unit II

Natural Hazards: Hazards, Disasters, and Nature Processes - Evaluating Hazards: History, Linkages, Disaster Prediction, and Risk Assessment - Fundamental principles concerning Nature Hazards - Human response to Hazards - Global Climate and Hazards - Population Increase, Land - use Change and Nature Hazards.

Unit III

Volcanoes and Earthquakes: Earthquakes: Magnitude and intensity. Plate boundary related Earthquakes - Earthquake processes (Faulting, Tectonic group). Earthquake shaking (seismic waves, seismograph) -Earthquake cycle - Earthquake caused by Human Activity- Effects of Earthquakes – Tsunami - Earthquake risk and Earthquake prediction - Earthquake warning system. Volcanic activity - Volcanic Hazards, Forecasting volcanic activity. Landslides: Human use Landslide - Minimising the Landslide Hazards- Perception of Landslides,

Unit IV

River, Flooding, and Coastal Hazards: Rivers and Flooding: Sediments in River - River velocity, Discharge, Erosion, and Sediments deposition- Effects of Land - use Change - Channel Pattern & Floodplain Formation - River Flooding - Urbanisation & Flooding- The Nature and Extent of Flood Hazards - Adjustments to Flood Hazards - Perception of Flooding. Coastal processes: Erosion - Coastal Hazards & Engineering structure - Human activity and Coastal erosion - Perception of and Adjustment to Coastal Hazards.

Unit V

Resources and Pollution: Water Resources: A brief global prospective surface water – Groundwater - Interactions between surface water and Ground water - Desalination – Water Managements - Water and Ecosystem. Water Pollution: Selected Water Pollutions – Oxygen - Demanding Waste - Pathogenic Organisms - Nutrients - Toxic Substances - Synthetic Organic Chemicals – Heavy Metals - Surface Water Pollution and Treatment- Point Source and Non-point Source - Ground water Pollution and Treatment. Mineral resources: Mineral of Human use - Geology of Mineral Resources - Environmental Impact of Mineral Development - Recycling Mineral Resource Energy. Geothermal Energy.

REFERENCES AND TEXTBOOKS

1. Valdiya, K.S (1987), Environmental Geology – Indian Context. Tata McGraw-Hill., Delhi.
2. Kellar, E.A. 1979, Environmental Geology, Charles. Merrill Publishing Co.ohio.
3. Lundgren, I. 1986, Environmental Geology, Prentice Hall.

SEMESTER V
PAPER-5
CRYSTALLOGRAPHY

Objective:

To familiarize about the nature , forms, habit, symmetry elements, measurements of interfacial angles and Twin crystals. The classification of crystal into system and classes.

Unit I

Definition of crystal – morphological characters of crystal – faces –forms – edges, solid angles – Interfacial angle. Contact Goniometer and its uses. Symmetry elements – crystallographic axes – crystal notation – parameter system of Weiss and Miller indices – axial ratio – laws of crystallography – the law of constancy of symmetry , the law of constancy of interfacial angles and the law of rational indices.

Unit II

Classification of crystals into systems and classes - Holohedral , Hemihedral, Hemimorphic and Enantiomorphic forms in crystals. Elementary knowledge of spherical and stereographic projections. study of the symmetry elements, and forms of the Normal, pyritohedral , tetrahedral and plagiohedral classes of cubic system with special reference to well developed crystals of Galena, Spinel , Garnet, Fluorite , Diamond , Pyrite , Tetrahedrite , Boracite and cuprite.

Unit III

Study of symmetry elements and forms of Normal, Hemimorphic, Tripyramidal, Pyramidal Hemimorphic, Sphenoidal and Trapezohedral classes of Tetragonal system with special reference to well developed crystals of zircon, Rutile, Cassiterite, Vesuvianite, Apophyllite, Shellite, Melonite, Wulfenite and Chalcocopyrite.

Unit IV

Study of the symmetry elements and forms of Normal, Hemimorphic Tripyramidal, pyramidal Hemimorphic, Trapezohedral, Rhombohedral , Rhombohedral Hemimorphic , Trirhomboidal and Trapezohedral classes of Hexagonal system with special reference to well developed crystals of Beryl , Zincite, Apatite , Calcite , Corundum , Tourmaline, Phenacite and Quartz. Study of the symmetry elements and forms of the Normal , Hemimorphic and Sphenoidal classes of Orthorhombic system with special reference to well developed crystals of Barite , olivine topaz, staurolite, Sulphur, Calamine, Struvite and Epsomite.

Unit V

Study of the symmetry elements and forms of the Normal classes of the Monoclinic and Triclinic systems with special reference to well developed crystals of Gypsum, Orthoclase, Albite, Augite, Axinite and Kyanite. Twin crystals – Definitions – Effects of Twinning – laws of twinning – composition plane, twinning plane and twinning axis, indices of twins – simple and repeated (polysynthetic twins), contact and penetration twins: secondary twins. Study of twin laws pertaining to the following crystals – Fluorite (spinel law), Pyrite (iron cross twin). Rutile (geniculate), Calcite, Quartz (Brazil law), Aragonite (mimetic twin), Staurolite (cruciform), Gypsum, Augite and Feldspars (Carlsbad, Baveno, Manebach, Albite and Pericline).

TEXT BOOKS

1. Dana, F.S.(1955): A text book of mineralogy - Asia Publishing House - Willey.
2. Wade., F.A. & Mattox, R.B. : Elements of crystallography and mineralogy, Harper Bros.(1960)
3. Phillips, P.C (1956): An introduction to crystallography Longmans green & co.,
4. Kerr.P.F : Optical Mineralogy.

REFERENCE BOOKS

1. Phillips, W.R.: Optical Mineralogy, Griffen, D.T.1986.
2. Walhstrom, E.F.1960 : Optical crystallography – John wiley.
3. Winchel, A.n. 1968 : Elements of optical mineralogy, part 1 & 2 wiley Eastern.
4. Smith H.G.: Minerals under microscopy – Murby.

PAPER-6
MINERALOGY

Objective:

To learn about the physical, chemical and optical properties of minerals and their utility in the mineral based industries.

Unit I

Definition of Mineral and Mineraloid, Scope of Mineralogy - Chemical elements and Periodic Table - Bonding of atoms and their types – Structure and classification of silicates - Isomorphism, polymorphism and pseudomorphism in minerals - Physical properties of minerals – Optical properties of minerals - Determination of specific gravity of minerals - Jolly balance and Beam balance methods – Outline of blow pipe tests.

Unit II

Mineralogy, structure, chemical composition, optical and physical properties, modes of occurrence and industrial uses of the following group of minerals: Quartz - Feldspar - Feldspathoid - Zeolite.

Unit III

Mineralogy, structure, chemical composition, optical and physical properties, modes of occurrence and industrial uses of the following group of minerals: Pyroxene – Amphibole – Mica - Olivine - Garnet.

Unit IV

Physical and optical properties, chemical composition, uses and modes of occurrence of the following minerals: Epidote, Chlorite, Scapolite, Cordierite, Talc, Serpentine, Steatite, Calcite, Dolomite, Andalusite, Kyanite, Sillimanite, Topaz, Staurolite, Beryl, Tourmaline, Wollastonite, Fluorite, Apatite, Zircon, Rutile, Sphene and Corundum.

Unit V

Mineralogy, mode of occurrence, uses and distribution in India of the minerals required for the following industries: Abrasives, Fertilizer, Paint, Refractory, Glass, Ceramic and Cement - Mineral wealth of Tamil Nadu.

REFERENCES AND TEXTBOOKS

1. Berry, L.G., Mason, B.H and R.V. Dietrich (1983). Mineralogy: Concepts, Descriptions, Determinations. W.H. Freeman & Co., 612p.
 2. Dana, E.S (2011). A Text-Book of Mineralogy, Read Books Design Publishers, London.
 3. Dana, J.D (2012). Manual of Mineralogy, Merchant Books Publilshers, New York.
 4. Erni, H (2010). Mineralogy Simplified, Forgotten Books Publishers, London, 436 p.
 5. Mason, B and Berry, L.G (1978). Elements of Mineralogy, W.H. Freeman & Co.
 6. Nesse, W.D (2014). Introduction to Mineralogy, Oxford University Press, USA.
- Rutley, F (2012). Rutley's Elements of Mineralogy, Springer Science & Business Media, New Delhi, 560p.

PAPER - 7
ECONOMIC GEOLOGY

Objective:

To learn about the distribution and mode of occurrence of minerals, minerals used in various industries, and uses of Gemstones.

Unit I

Historical development of economic Geology. Materials of mineral deposits – ore minerals, gangue minerals, tenor and grade or ores. classification of mineral deposits. Outline of Lindgren's and Bateman's classification. Controls of ore localization – structural controls, stratigraphic physical and chemical – brief study of metallogenetic epochs and provinces – geologic thermometers.

Unit II

Magmatic processes. – mode of formation – Early magmatic processes and deposits, disseminations. segregations and injections – Late magmatic processes and deposits – Residual liquid segregation and injection – immiscible liquid segregation and injection – sublimation. Contact Metasomatic processes – the process and effects – resulting mineral deposits. Hydrothermal processes – principles – Factors affecting deposition – wall rock alteration – minerals sequence – cavity filling deposits Fissure veins, shear – zone, stock-work, saddle reef, ladder vein, fold cracks, breccia filling, solution cavities, pore space and vesicular filling – replacement deposits, the process and deposits – criteria of replacement.

Unit III

Sedimentary processes and cycles – principles involved in sedimentation – cycles of Iron and manganese, weathering processes – principles- Residual concentration process and deposits – mechanical concentration principles – euvial, alluvial, beach and eolian placers – paystreak and bonanza. Oxidation and supergene sulphide enrichment – solution and deposition in the zone of oxidation – secondary sulphide enrichments – Gossans and capping. Metamorphic processes – Formation of Graphite, Asbestos, Talc, Soapstone and Sillimanite group of minerals.

Unit IV

Diagnostic physical properties, chemical composition, uses, modes of occurrence and distribution in India of the following economic minerals. Graphite, Realgar, Orpiment, Stibinite, Molybdenite, Cinnabar, Anglesite, Barite, Gypsum, Celestite, Corundum, Ochre, Ilmenite, Chromite, Franklinite, Cassiterite, Magnesite, Cerussite, Halite, Fluorite, Phosphatic Nodule, Monazite, Wollastonite, Colembite, Tantalite, Samarskite, Asbestos, Steatite and Vermiculite. Mineralogy, mode of occurrence, uses and distribution in India of the following precious metals and minerals. Gold

deposits – Gem stones. Character, distribution and mode of occurrence of structural and building materials.

Unit V

Mineralogy, mode of occurrences, uses and distribution in India of the following metalliferous deposits – Iron, Manganese, aluminium, copper, lead, Zinc – chromium. Fossil fuels – coal – uses, classification, constitution, origin and distribution in India. Petroleum- composition, uses, theories of origin, oil traps, and important oil fields of India.

TEXT BOOKS AND REFERENCE BOOKS

1. Bateman Allan (1962) M. Economic Mineral Deposits, Asian Publishing House, 2nd Edition.
2. Lindgren W.(1993)Mineral Deposits, Mc Graw Hill.
3. Coggin, B. and Dey, A.K.(1955)India's Mineral Wealth.
4. Park, C.F. and Macdiarmid, R.A (1970) Ore deposits, Freeman.
5. Krishnaswamy ,s. India's Mineral Resources, Oxford and IBH.
6. Deb.S. (1980), Industrial Minerals and Rocis of India, Allied.
7. Gokhale, K.V.G.K. and Rao , T.C(1978) Ore deposits of India, their distribution and processing, Thosmson press.

**ELECTIVE
PAPER - 1
MINING GEOLOGY**

Objective:

To study about the open cast and underground mining operations, sampling techniques, mining equipments and Mitigation of mining hazards.

Unit I

Sampling – Principles – types – collection of sample – core samples and their preservation. Drilling – brief account of different types of drilling – Geological logging of borehole samples.

Unit II

Methods of breaking rocks – A short note on explosives. Surface mining open cast. Alluvial mining: Panning – Sluicing – Hydraulicking – Dredging - mine support and stoping – shaft sinking.

Unit III

Subsurface mining: Criteria to choose subsurface mining, Definition of mining terms: Shaft, Level, Adit, Hanging wall, Footwall, Drive, Cross cut, Tunnel, Raise, Winze and Chute. Stopping – Open stopes – Supported stopes – pillar – Square set filled – Shrinkage stopes, Glory hole mining. Caving methods: Top slicing, Sub level caving, Block caving, Coal mining, Prospecting and Planning – Strip mining – Augering – Room and Pillar method – Long wall method.

Unit IV

Introduction to Mineral Economics; Essential critical and strategic minerals Demand and Supply National Mineral Policy – Problems and Prospects – Industrial policy Resolutions, 1956 – Schedule – A, Schedule – B, Energy policy, Forest policy. Evolution of National Mineral policy – Ideal Scope of a mineral policy – Categories of minerals for grant of concessions – Minor minerals – Major minerals. Procedure for obtaining mineral concession – Termination, surrender and Determination of mining lease – The oil fields (Regulation & Development) Act, 1948 – The mines & minerals (Regulation & Development) Act, 1957 – Mineral concession Rules, 1960 – The mining leases (Modification of terms) Rules, 1956 – Minerals conservation and development Rules, 1958.

Unit V

The Coal mines Act, 1974 – The Atomic energy Act, 1957 – The Atomic energy Act, 1962 – The mines Act, 1952 – Mines Rules, 1955 – Coal mines Regulation , 1957 – Metaliferous mines regulation, 1961 – Mineral Taxation and Incentive measures – Incidence of Taxes – Incentive measures – Depletion Allowance – Simplification of Taxation laws.

TEXT BOOKS AND REFERENCE BOOKS

1. R.N.P. Arogyasamy, Courses in mining Geology, Oxford & IBH Publishing Co.
2. Mckinstry- Mining Geology.
3. K.K. Chatterjee -An Introduction to Mineral Economics.
4. R.K. Sinha & N.L. Sharma- Mineral Economics.
5. Thomas R.T. (1979) – An Introduction to Mining – Methun.

**SKILL BASED SUBJECT
PAPER - 3
GEMMOLOGY**

Objective:

To understand about the Physical, Chemical and Optical properties of Gemstones, occurrences and distribution of gemstones and Gemstone treatments.

Unit I

Introduction to Gems - Basic properties of gems. Formation of gem stones. Nature of gem material: quality necessary in gems-beauty, rarity, durability. Distinction between crystalline, amorphous and metamict materials. Crystal form and habit. Classification of gem stones. Observations with hand lens (10x)-importance and uses. Units of measurement: metric scale, carat, pearl and grain.

Unit II

Nature of crystals: distinction between crystalline and amorphous material, crystal symmetry, Twinning, parallel growth, crystal form, crystal habit, seven crystal system. Identification of rough stones.

Unit III

Physical properties: hardness and its applications in gemmology and limitations. Cleavage, Fracture, parting, and their importance in gemology and lapidary work. Specific gravity-utility and determination by hydrostatic weighing, heavy liquids, floatation and pycnometer. Inclusions and other features of gemstones.

Unit IV

Optical properties: The electromagnetic spectrum, reflection and its importance in gemology-lustre, aventurescence, sheen, chatoyancy, asterism, luminescence, play of colours, labradorescence, inclusions etc.. Laws of refraction, refractive index (R.I), total reflection- in design of refractometer. Construction and use of refractometer. Polariscope-construction and use in gemmology. Dichroscope construction, use of Chelsea colour filter, Infra-red ultraviolet and x-rays in gem identification.

Unit V

Enhancement and treatments- enhancement methods -coloured and colourless impregnation, dyeing, bleaching and its identification. Methods of treatment – laser drilling, irradiation, heat treatment, surface modifications, diffusion treatment and its identification. Composites - types, classification and identification.

REFERENCE AND TEXTBOOKS

1. Karanth,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. Metheun,London.
11. Read,P.G. (2005). Gemmology, 3rd ed. Elsevier,Singapore.
12. Walton,L. (2004). Exploration Criteria for Colored Gemstones, Canada.

SEMESTER VI

PAPER - 8

IGNEOUS PETROLOGY

Objective:

To learn about the formation of rock due to Igneous activity and magma types, Classification of Igneous Rocks, Petrography and Petrogenesis of various igneous rocks.

Unit I

Definition of Petrology – Earth zones. Composition and constitution of magmas – Primary and Parental Magmas. Forms of Intrusive igneous rocks: Concordant forms - Sill, Laccolith, Lopolith and Phacolith, Discordant forms - Dykes, Cone Sheets, Volcanic neck, Ring dyke, Batholiths, Stocks, Bosses and Psymaliths. Forms of Extrusive igneous rocks: Lava flows, Pyroclastic deposits - Agglomerate, Lapilli, volcanic ash and volcanic froth

Unit II

Structures vesicular and Amygdaloidal structures – block lava – Ropy lava – pillow structure – flow structure – sheet joints- mural jointing – columnar jointing – rift and grain. Textures: Definition and description - crystallinity: crystallites and microlites – Devitrification – Granularity – shapes of crystals , mutual relations – Equigranular textures: allotriomorphic hypidiomorphic, Panidiomorphic. inequigranular Textures: porphyritic and Intergrowth texture – Trachytic texture – Intergrowth texture structures orbicular structure Spherulitic structure – Perlitic fracture. , Directive textures, Overgrowth textures, Reaction textures - Micro Structures

Unit III

Classification: bases of classification – megascopic classification – classification based on colour index – based on the proportion of Alkali to plagioclase feldspars. Based on silica saturation – based on alumina saturation – A short account of CIPW classification , Normative minerals, salic and femic groups – mention of the main divisions, classes, orders, suborders, rangs and subrang only. Merits and defects of CIPW classification – Tyrrels tabular classification.

Unit IV

Texture, Mineralogy, Classification, and Modes of occurrence of: Granite, Granodiorite, Syenite, Diorite, Gabbro, their hypabyssal and volcanic equivalents. Petrographic characters, distribution in India and origin of Pegmatites, Lamprophyres, Alkaline rocks, Dunite, Peridotite and Anorthosites.

Unit V

Crystallization of Unicomponent magma – Crystallization and petrogenetic significance of Binary magmas: Diopside – Anorthite Eutectic system, Albite – Anorthite Solid-Solution system, Forestrite – Silica incongruent melting system and Ternary system (Ab – An – Di). Reaction principle and Bowen's reaction series - Causes for the diversity of Igneous rocks – Magmatic Differentiation: Fractional Crystallization, Liquid immiscibility, Assimilation - Short notes on: Consanguinity, Variation diagrams and petrographic provinces.

REFERENCE AND TEXTBOOKS

1. Tyrrel, G.W. (1978) The principles of petrology – Chapman and Hall Ltd., London.
2. Bowen, N.L. The Evolution of the Igneous Rocks – Dover publication, Inc, New York.
3. Barth, FW. (1962) Theoretical petrology - Wiley.
4. Walstrom, E.E. (1961) Theoretical Igneous petrology, Wiley.
5. Turner.F.J and Verhoogen.J –1960.- Igneous and Metamorphic petrology – McGraw Hill.
- 6.Hatch, F.H. Wells, A.K.(1949),Petrology of Igneous Rocks, Thomas Murby & Wells, M.K. 7.Johannesen, A (1962) Descriptive petrography of Igneous Rocks.

PAPER - 9

SEDIMENTARY AND METAMORPHIC PETROLOGY

Objective:

To learn about the occurrence, origin, classification, texture and structure, petrographic and petrogenesis of sedimentary and metamorphic rocks.

Unit I

Sedimentary process – disintegration & decomposition of rocks – transportation – deposition – diagenesis. A broad classification of sedimentary rocks into residual mechanical, chemical and organic Groups. Structures of sedimentary rocks. mechanical, chemical and organic structures. Textures of sedimentary rocks – clastic and non – clastic textures.

Unit II

Residual deposits – terra rossa , clay, laterite and bauxite and soils. Mechanical deposits – rudaceous, arenaceous and argillaceous groups. Heavy minerals in sand and sandstones. A descriptive study of Conglomerate, Breccia, Sandstones and Shales.

Unit III

Chemical deposits – siliceous , carbonaceous, ferruginous and salt deposits. organic deposits – calcareous, siliceous, phosphatic, ferruginous and carbonaceous deposits. A brief study of Flinit, Chert, Siderite, Gypsum, Rock Salt, Caliche. Guano and Kiesellgher. Descriptive study of different types of calcareous and carbonaceous deposits.

Unit IV

Definition of metamorphism – Agents and kinds of metamorphism – facies, zones and grades of metamorphism – metamorphic structures and textures. cataclastic metamorphism and its products. Retrograde metamorphism. Thermal metamorphism of pelitic sediments, pure and impure calcareous rocks. A brief study of Breccia, Flaser, Mylonite, Hornfels, Marble, Ophicalcite.

Unit V

Dynamo thermal metamorphism of pelitic sediments. plutonic metamorphism petrography and origin of charnockites – metamorphic differentiation – pneumatolytic injection metamorphism – anatexis and palingenesis. Brief study of Slate, Phyllite, Quartzite, Schist. Gneiss, Granulite, Leptynite, Charnockite, Eclogite, Amphibolite, Schorl, Adinole, Lit- Par- Lit – gneiss and Migmatite.

REFERENCE AND TEXTBOOKS

1. Tyrrel, G.W- Principles of petrology, Asia Publishing House.
2. Huang, W.T.-Petrology, MC Graw Hill
3. Pettijhon, F.J.-Sedimentary Rocks, Harper & Bros.
4. Harker, A. -Petrology for Students, Cambridge,
5. Turner,F,J &Verhogen,J -Igneous and Metamorphic Petrology, MC Graw Hill.
6. Williams, H, Turner, F.j. & Gillibert, C.M. - Petrography, Freeman.
7. Winkler, A. G.F.- Petrogenesis of Metamorphic Rocks, Mc Graw Hill.

**PAPER - 10
HYDROGEOLOGY**

Objective:

To learn about the origin of groundwater and its distribution, Geological favouring condition of aquifers and its types, Groundwater occurrence in igneous, sedimentary and metamorphic rocks, evaluation of various aquifer parameters through pump tests and effects of Groundwater quality in various rock types.

Unit I

Definition of hydrogeology and groundwater – Types of groundwater based on origin - Hydrological cycle - Vertical distribution of ground water – Springs: types, geological conditions favouring development of springs - Definition of aquifers, aquitards and aquicludes - Types of Aquifers: unconfined, semi-confined, confined and perched – Artesian wells.

Unit II

Rock properties affecting groundwater: types of openings, porosity, specific yield, specific retention and permeability – Groundwater movement – Darcy's law and its applications – Determination of permeability in field and lab – Groundwater occurrence in igneous, sedimentary and metamorphic rocks.

Unit III

Groundwater exploration by electrical resistivity method – Outline of dug wells, tube wells, jetted wells, infiltration galleries and collector wells – Well design and development – Fluctuations of groundwater – Groundwater recharge methods.

Unit IV

Sea water intrusion: causes, consequences and, preventive and control measures – Groundwater resources of Tamil Nadu including its quality, Ground water quality in various rock types – Parameters considered for assessing groundwater quality suitability for drinking and irrigation purposes – The latest drinking and irrigation water standards of WHO and BIS – Waterborne diseases .

Unit V

Groundwater Recharge:- Recharge methods - Basin method, Stream channel method, Ditch or Furrow method, Flooding method, Irrigation method, Pit method, Recharge well method. Rainwater Harvesting systems.

REFERENCE AND TEXTBOOKS

1. Todd, D.K and L.W. Mays (2004). Groundwater Hydrology. John Wiley & Sons.
2. Davis, S.N. & Deweist., R.J.M (1966). Hydrogeology , John Wiley & Sons, New York
3. Rangunath, H.M (2007). Groundwater, New Age International Publishers, Delhi
4. Karanath, K.R (1987). Groundwater Assessment, Development & Management, Tata Mc Graw Hill.
5. Ramakrishnan, S (1998). Groundwater. K.G. Graph Arts, Chennai.

CORE PRACTICAL - 3
CRYSTALLOGRAPHY AND MINERALOGY

CRYSTALLOGRAPHY

CRYSTAL MODELS

Identification and description of the following crystal models: Galena, Garnet, Fluorite, Pyrite, Tetrahedrite, Boracite, Sphalerite, Cuprite, Zircon, Cassiterite, Rutile, Octahedrite, Apophyllite, Vesuvianite, Scheelite, Meonite, Wulfenite, Chalcopyrite, Beryl, Zincite, Apatite, Calcite, Haematite, Dolomite, Corundum, Tourmaline, Phenacite, Diopside, Quartz, Olivine, Topaz, Barite, Andalusite, Cordierite, Sulphur, Staurolite, Hypersthene, Calamine, Struvite, Epsomite, Gypsum, Orthoclase, Augite, Hornblende, Epidote, Sphene, Axinite, Albite, Kyanite and Rhodonite.

SIMPLE TWIN MODELS

Galena, Fluorite, Pyrite, Rutile, Calcite, Quartz, Staurolite, Gypsum, Augite, Orthoclase, Albite.

MINERALOGY

Megascopic Mineralogy:

Description of megascopic properties and their identification of the following minerals: Quartz, Rosy quartz, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal, Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Nepheline, Leucite, Sodalite, Enstatite, Bronzite, Hypersthene, Diopside, Augite, Spodumene, Acmite, Rhodonite, Wollastonite, Anthophyllite, Tremolite, Actinolite, Hornblende, Glaucophanite, Olivine, Serpentine, Muscovite, Biotite, Vermiculite, Chlorite, Epidote, Garnet, Olivine, Natrolite, Stilbite, Apophyllite, Talc, Steatite, Andalusite, Kyanite, Sillimanite, Staurolite, Cordierite, Apatite, Beryl, Topaz, Calcite, Dolomite, Tourmaline, Zircon, Fluorite.

Microscopic Mineralogy:

Description of optical properties and their identification of the following minerals: Quartz, Orthoclase, Microcline, Albite, Labradorite, Nepheline, Leucite, Enstatite, Hypersthene, Augite, Diopside, Hornblende, Glaucophanite, Biotite, Muscovite, Olivine, Epidote, Garnet, Apatite, Zircon, Sphene, Tourmaline, Calcite, Andalusite, Kyanite, Sillimanite, Staurolite, and Cordierite

Blow Pipe:

Identification of the following mineral powders by simple blow pipe tests: Apatite, Barite, Calcite, Celestite, Cerussite, chalcopyrite, Galena, Gypsum, Chromite, Haematite, Magnesite, Magnetite, Psilomelane, Pyrolusite, Siderite, Sphalerite, Strontianite, Witherite, Stibnite, Ilmenite and Wolframite.

CORE PRACTICAL - 4

PETROLOGY AND ECONOMIC GEOLOGY

Megascopeic identification of the following rocks: Granite, Graphic granite, Pegmatite, Aplite, Schorl Rock, Granite Porphyry, Syenite, Syenite porphyry, Diorite, Gabbro, Anorthosite, Dunite, Pyroxenite, Dolerite, Dolerite Porphyry, Basalt, Trachyte, Rhyolite, Obsidian, Pumice, Scoria. Conglomerate, Breccia, Sandstone, Arkose, Shale, Limestone, Laterite, Peat, Lignite, Slate, Phyllite, Schists, Gneisses, Quartzite, Marble, Amphibolite, Eclogite, Leptynite, Charnockite, Khondalite, and Basic Granulite.

Microscopic identification and description of the following rocks: Mica Granite, Hornblende Granite, Tourmaline Granite, Schorl Rock, Aplite, Graphic Granite, Mica Syenite, Hornblende Syenite, Nepheline Syenite, Diorite, Gabbro, Norite, Dunite, Peridotite, Granite – porphyry. Syenite – porphyry, Diorite – porphyry, dolerite, minette, Vogasite, Anorthosite, Trachyte, Andesite, Basalt, Phonolite, Volcanic Breccia, Vitrophyre, Conglomerate, Breccia, Sandstone, Arkose, Shale Limestone, Slate, Chlorite Schist, Mica Schist, Kyanite Schist, Staurolite Schist, Garnetiferous Schist, Glaucophane Schist, Granulite, Charnockite, Eclogite Amphibolite, Leptynite, Khondalite, Cordierite, Gneiss, Garnet – Sillimanite Gneiss, Calc Granulite.

ECONOMIC GEOLOGY

Megascopeic identification and description, Indian occurrences and uses of the following ore and industrial Minerals: Realgar, Orpiment, Stibnite, Molybdenite, Galena, Sphalerite, Cinnabar, Covelite, Bornite, Chalcophyrite, Pyrite, Arsenopyrite, Marcasite, Barite, Celestite, Gypsum, Cuprite, Zincite, Corundum, Hematite, Ilmenite, Magnetite, Chromite, Franklinite, Cassiterite, Rutile, Pyrolusite, Psilomelane, Goethite, Limonite, Bauxite, Calcite, Dolomite, Magnesite, Siderite, Aragonite, Witherite, Strontionite, Cerussite, Azurite, Malachite, Chrysocolla, Columbite, Halite, Fluorite, Phosphatic Nodule, Monazite, Graphite, Coal and its varieties.

**ELECTIVE
PAPER - 2
GEOGRAPHIC INFORMATION SYSTEM**

Objective:

To learn about the basic aspect of Geographic information system, , types of vector and raster data and GIS application in Geology.

UNIT-I

Geographic information system-concepts-data structure: GIS Hardware and software component. Polygon structures- Arc node-animation-simulation-digitization-Manual methods.

UNIT-II

Spatial data-introduction-maps and their influence on the character of spatial data. Thematic characteristics. Other sources of spatial data, Spatial data models, structures and computer applications.

UNIT-III

Attribute data management-introduction-database data models-creating a data base-GIS data base applications.

UNIT-IV

Spatial data-Raster data-Vector data-Development in data base-data input and editing.

UNIT-V

Exposure to GIS software - GIS packages - GIS applications in Agriculture, soils and Geology.

REFERENCE AND TEXTBOOKS

1. Burrough, P.A (1989) Principles of Geographical Information Systems for land Resources Assessment Clarandone Press, oxford.
2. Tor Bernhardsen, (2007) Geographical Information Systems –An Introduction.
3. Kang –Tsung Chang (2002) Introduction to Geographical Information Systems, MC Graw Hill, Boston.
4. Campbell, J (1984) Introductory Cartography, Printers Hall Englewood Cliffs, N.J.

**ELECTIVE
PAPER - 4
MARINE GEOLOGY**

Objective:

To understand about the Physical and chemical properties of Ocean water, behavior of tides and waves, marine resources, physical, chemical and biological oceanography.

Unit I

Introduction and historical development, physical features and origin of Ocean Basin. Submarine topographic forms – continental margin, ocean basin floor, mid – ocean ridge system, submarine canyons, oceanic trenches, seamounts and guyots. A brief outline of formation, development and classification of coast.

Unit II

Physical and chemical properties of Ocean water. General oceanic circulation of water waves and currents – Factors affecting surface flow of currents – Coriolis effect Ekman's spiral. Tides and their types. Natural mineral resources of the ocean, law of the sea and its implications.

Unit III

Physical Oceanography: T-S diagrams; mixing processes in the oceans; characteristics of important water masses. Wind generated waves in the oceans; their characteristics; shallow and deep water waves. Propagation, refraction, and reflection of waves. Wave spectrum, principles of wave forecasting. Tide-producing forces and their magnitudes; prediction of tides by the harmonic method; tides and tidal currents in shallow seas, estuaries and rivers.

Unit IV

Chemical Oceanography: Composition of seawater – Classification of elements based on their distribution; major and minor elements, their behavior and chemical exchanges across interfaces and residence times in seawater. Chemical and biological interactions – Ionic interactions; biochemical cycling of nutrients, trace metals and organic matter. Air-sea exchange of important biogenic dissolved gases; carbon dioxide, carbonate system; alkalinity and control of pH; biological pump.

Unit V

Biological Oceanography: Classification of the marine environment and marine organisms. Physio-chemical factors affecting marine life – light, temperature, salinity, pressure, nutrients, dissolved gases; adaptation and biological processes. Primary and

secondary production; factors controlling phytoplankton and zooplankton abundance and diversity; plankton and fisheries oceanography; benthic organisms; coastal marine communities and community ecology – estuaries, coral reefs and mangrove communities, deep-sea ecology including hydrothermal vent communities.

REFERENCE AND TEXTBOOKS

1. Kuenen, Ph.H., 1950, Marine Geology, Wiley.
2. Shepard, F.P., 1973, Submarine Geology, Harper and Row.
3. Paul R Pinet, 1999, Oceanography, West Publishing Company, USA.
4. Valdiya, K.S (1987), Environmental Geology – Indian Context. Tata McGraw-Hill., New Delhi.
5. Kellar, E.A. 1979, Environmental Geology, Charles. Merrill Publishing Co.ohio.
6. Lundgren, I. 1986, Environmental Geology, Prentice Hall.
- 7.K.Siddhartha (2013)"Oceanography A Brief Introduction

**SKILL BASED SUBJECT
PAPER - 4
MINERAL EXPLORATION**

Objective:

To understand about the various techniques used for mineral exploration, basic principles, instruments, data generation in the field and 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.

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.

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.

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). Outlines 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.
13. 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.

Geological Field work

It is an integral part of the course, students should be taken to a field training during the academic year.

First Year

Students should be taken in the local area for studying geomorphological, structural aspect of geology. The duration of the trip may be a week and submit a report to the department.

Second Year

Students should be taken to nearby area and familiarize Paleontological and Stratigraphical aspect, collect samples from the field and display at the time of their practical examination for internal evaluation. The duration may be a week.

Third Year

A visit to geologically interested and mineralized zones within Tamilnadu it include mine visit, geological mapping, minerals, rocks collection and display at the time of their practical examination for internal evaluation. The duration may be a week.