

PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636 011



DEGREE OF BACHELOR OF SCIENCE

CHOICE BASED CREDIT SYSTEM

Syllabus for
B.Sc. APPLIED GEOLOGY
(SEMESTER PATTERN)

**(For Candidates admitted in the Colleges affiliated to Periyar University from
2021-2022 -onwards)**

REGULATIONS**ELIGIBILITY**

Refer this office circular No: PU/R/AD-1/UG/PG/Programs Eligibility/2019 Dated: 16-04-2019.

1.DURATION OF THE COURSE

The course for the degree of Bachelor of Science shall consist of three years divided into six semesters with internal assessment under choice based credit system.

2.COURSE OF STUDY

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

SEMESTER - I

1. Language - I (Tamil etc.)
2. Communicative English-I
3. Core Geology Paper - I- Physical Geology and Geodynamics
4. Allied Chemistry Paper - I (or) Allied Mathematics Paper-I
5. Skill Based Elective Course-I (Select any one from list-1 SBEC)
6. Value education
7. Professional English – I

SEMESTER - II

8. Language - II (Tamil etc.)
9. Communicative English - II
10. Core Geology Paper - II-Geomorphology and Structural Geology
11. Core Geology Practical Paper - I* Structural Geology and Surveying
12. Allied Chemistry Paper-II (or) Allied Mathematics Paper - II
13. Allied Chemistry Practical Paper-I* (or) Allied Mathematics Paper - III
14. Skill Based Elective Course – II (Select any one from list – 1 SBEC)
15. Environmental Studies
16. Professional English – II
17. Language Proficiency for Employability- Effective English

SEMESTER - III

18. Language - III (Tamil etc.)
19. Communicative English - III
20. Core Geology Paper – III Palaeontology
21. Allied Physics Paper - I
22. Skill Based Elective Course – III (Select any one from list-1 SBEC)
23. Non -Major Elective Course - I

SEMESTER - IV

24. Language - IV (Tamil etc.)
25. Communicative English - IV
26. Core Geology Paper – IV Stratigraphy
27. Core Geology Practical Paper - II Paleontology and Stratigraphy
28. Allied Physics Paper - II
29. Allied Physics Practical Paper - I*
30. SBEC IV-Digital Skill for Employability- Office Fundamentals
31. Non -Major Elective Course - II
32. Add on course-Internship Training.

SEMESTER - V

33. Core Geology Paper – V Crystallography
34. Core Geology Paper – VI Mineralogy
35. Core Geology Paper - VII Igneous Petrology
36. Core Geology Paper - VIII Sedimentary and Metamorphic Petrology
37. Skill Based Elective Course – V (Select any one from list - 1 SBEC)
38. Skill Based Elective Course – VI (Select any one from list - 1 SBEC)

SEMESTER - VI

39. Core Geology Paper - IX Economic Geology
40. Core Geology Paper - X Photogeology and Remote Sensing
41. Core Geology Paper - XI Mining and Engineering Geology
42. Core Geology Paper - XII Hydrogeology and Environmental Geology
43. Core Geology Practical Paper - III* Crystallography and Mineralogy
44. Core Geology Practical Paper - IV* Economic Geology and Petrology
45. Skill Based Elective Course – VII (Select any one from list-1 SBEC)
46. Add on course-Employability Readiness.

LIST - 1: SKILL BASED ELECTIVE COURSES

1. Mapping Techniques in Geology
2. Gemology and Gemstone Evaluation
3. Field Hydrogeology and Techniques
4. Water Quality Analysis
5. Granite Exploration and Exploitation
6. Geostatistics and Computer Applications
7. Remote Sensing and GIS
8. Mines and Minerals Legislation of India
9. Introduction to Geoinstrumentation
10. Cartography
11. Geology for Competitive Examination
12. Principles of Surveying

LIST - 2: NON-MAJOR ELECTIVE COURSES

1. Oceanography
2. Climatology
3. Basic Geochemistry
4. Basic Geophysics
5. Geohazards
6. Groundwater Management and Rainwater Harvesting

LIST - 3: COMPULSORY COURSES

1. Value Education
2. Environmental Studies
3. Extension Activities (NSS, NCC, YRC, RRC, Green Club)

3. EXAMINATIONS

The Theory examination shall be three hours duration to each paper at the end of each semester. The candidates failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

4. SCHEME OF EXAMINATION

The scheme of examination of a different semester shall be as follows:

**B.Sc. GEOLOGY COURSE STRUCTURE UNDER CBCS
(FOR CANDIDATES ADMITTED FROM THE ACADEMIC YEAR 2021 ONWARDS)**

I – SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
I	Tamil or any other Language Paper –I	6	3	3	25	75	100
II	English - I Communicative English	6	3	3	25	75	100
III	Core I - Geology Paper – I	5	3	4	25	75	100
	Core II Geology Practical Paper –I*	3	-	-	-	-	-
	Allied Chemistry Paper–I(or)Allied Maths Paper –I	5	3	4	25	75	100
	Allied Chemistry Practical Paper –I*	2	-	-	-	-	-
IV	Skill based Elective course-I (Select any one from the list-1)	2	3	2	25	75	100
	Value education	1	3	2	25	75	100
	Professional English-Physical Science-I	6	3	4	25	75	100

s*Examinations will be at the end of II semester

II SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
I	Tamil or any other Language Paper –II	6	3	3	25	75	100
II	English –II Communicative English	4	3	3	25	75	100
	Language Proficiency for Employability- Effective English	2	3	2	25	75	100
III	Core III – Geology Paper – II	5	3	4	25	75	100
	Core IV - Geology Practical Paper –I*	3	3	5	40	60	100
	Allied Chemistry Paper–I(or)Allied Maths Paper –II	5	3	4	25	75	100
	Allied Chemistry Practical Paper –I* (or) Allied Maths Paper – III	2	3	4	40	60	100
IV	Skill based Elective course-I (Select any one from the list-1)	2	3	2	25	75	100
	Environmental Studies*	1	3	2	25	75	100
	Professional English-Physical Science-II	6	3	4	25	75	100

Continued from I semester and Examinations will be at the end of II semester

Total Credit for I and II Semester = 55 credits

Total Marks for I and II Semester = 1700 Marks

III SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
I	Tamil or any other Language Paper –III	6	3	3	25	75	100
II	English Paper –III	6	3	3	25	75	100
III	Core V - Geology Paper – III	5	3	4	25	75	100
	Core VI - Geology Practical Paper –II*	3	-	-	-	-	-
	Allied Physics Paper –I	5	3	4	25	75	100
	Allied Physics Practical Paper –I*	2	-	-	-	-	-
IV	NMSDC- Digital skills for Employability – Microsoft Office Essentials	2	3	2	25	75	100
	Non-Major Elective Course – I	2	3	2	25	75	100

*Examinations will be at the end of IV semester

IV SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
I	Tamil or any other Language Paper –IV	6	3	3	25	75	100
II	English Paper –IV	4	3	3	25	75	100
III	Core VII - Geology Paper – IV	5	3	4	25	75	100
	Core VIII - Geology Practical Paper –II*	3	3	5	40	60	100
	Allied Physics Paper –II	5	3	4	25	75	100
	Allied Physics Practical Paper –I*	2	3	4	40	60	100
IV	NMSDC- Employability Skills- Microsoft	2	3	2	25	75	100
	Non-Major Elective Course-II	2	3	2	25	75	100
	Add on course- Internship(Field visit and Report preparation)	-	-	-	-	-	-

Continued from III semester and Examinations will be at the end of IV semester

Total Credit for III and IV Semester = 45 credits

Total Marks for III and IV Semester = 1400 Marks

V SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
III	Core IX - Geology Paper – V	5	3	4	25	75	100
	Core X - Geology Paper – VI	5	3	4	25	75	100
	Core XI - Geology Paper – VII	5	3	4	25	75	100
	Core XII - Geology Paper – VIII	5	3	4	25	75	100
	Core XIII - Geology Practical – III	3	3	-	-	-	-
	Core XIV - Geology Practical – IV	3	3	-	-	-	-
IV	NMSDC- Marketing and Design Tools- Digital Marketing	2	3	2	25	75	100
	Skill based Elective course-VI (Select any one from the list-1)	2	3	2	25	75	100

***Examinations will be at the end of VI semester**

VI SEMESTER							
PART	SUBJECT	INSTRUCTION HRS/WEEK	EXAM HRS.	CREDITS	UNIVERSITY EXAMINATION		
					INTERNAL	EXTERNAL	TOTAL
III	Core XV - Geology Paper – IX	5	3	4	25	75	100
	Core XVI - Geology Paper – X	5	3	4	25	75	100
	Core XVII - Geology Paper – XI	5	3	4	25	75	100
	Core XVIII - Geology Paper – XII	5	3	4	25	75	100
	Core XIX - Geology Practical - III*	3	3	5	40	60	100
	Core XX - Geology Practical - IV*	3	3	5	40	60	100
IV	Skill based Elective course-VII (Select any one from the list-1)	2	3	2	25	75	100
IV	NMSDC- Innovative & Creative Skills for Employability- Content Writing & Digital Marketing	2	2	-	-	-	-

*Continued from III semester and Examinations will be at the end of VI semester

Total credit for V and VI Semester

= 48 credits

Credits Total Marks for V and VI Semester

= 1300 Marks

Total Credit for 3 years

= 148 Credits

Total Marks for 3 years

= 4400 Marks

5. QUESTION PAPER PATTERN FOR EXAMINATION

Time: 3 Hour

Maximum Marks: 75

Part-A (15 x 1=15 Marks)

(Answer all Questions) (Three questions from each unit)

Part - B (2 x 5=10 Marks)

(Answer any two Questions) (One question from each unit)

Part - C (5 x 10 = 50 Marks)

(Answer all Questions) (One question from each unit with internal choice)

6. MINIMUM PASSING MARKS

Theory

Internal Assessment : 25 marks

University Examination: 75 Marks

EVALUTION OF IA		PASSING MINIMUM	
Test	15 Marks	IA (40%)	10 Marks
Assignment	05 Marks	UE (40%)	30 Marks
Attendance	05 Marks	Total	40 Marks
Total	25 Marks		
UE	75 Marks		

Practical-

Internal Assessment : 40 marks

University Examination: 60 marks

EVALUTION OF IA		PASSING MINIMUM	
Field visit, Collections and Report	15 marks	IA (40%)	16 marks
Model Exam	05 marks	UE (40%)	24 marks
Record Submission	15 marks	Total	40 marks
Attendance	05 marks		

Total	40 marks		
UE	60 marks		

7. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed in First Class. All other successful candidates shall be declared to have passed in Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed in First Class with Distinction provide they pass all the examinations prescribed for the course at first appearance.

Candidates who pass all the examinations prescribed for the course in the first attempt and within a period of three academic years from the year of admission to the course alone are eligible for University Ranking.

EVALUATION OF CREDITS:

LETTER GRADE	CUMULATIVE GRADE POINTS AVERAGE	GRADE DESCRIPTION	RANGE OF MARKS
S	10	Outstanding	90-100
A	9	Excellent	80-89
B	8	Very Good	70-79
C	7	Good	60-69
D	6	Average	50-59
E	5	Satisfactory	40-49
RA	0	Re-Appear	0-39

~~(Marks obtained in course \times credit) 100~~

$GP = \frac{\text{Total grade points earned in a semester}}{\text{Total credits registered in a semester}}$

$GPA = \frac{\text{Sum of grade points earned}}{\text{Sum of credits registered}}$

$GPA = \frac{\text{Sum of grade points earned}}{\text{Sum of credits registered}}$

CLASSIFICATION:

CGPA	9 and above	I Class with Distinction
CGPA	Between 7 and 8.9	I Class
CGPA	Between 5 and 6.9	II Class

The above classification shall be given for overall performance including Non- Major Electives and Skill based Courses. i.e., For Performance in the Part III only.

8. MAXIMUM DURATION FOR THE COMPLETION OF UG PROGRAM

The maximum duration for the completion of UG Program shall not exceed twelve semesters.

9. COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2021 - 2022 and thereafter.

10. TRANSITORY PROVISION

Candidates who were admitted to the UG course of study before 2017 – 2018 shall be permitted to appear for the examinations under those regulations for a period for three years i.e. up to and inclusive of the examination of April/May 2021. Thereafter they will be permitted to appear only under regulations then in force.

11. SUBJECT AND PAPER CODES

PAPER	SUBJECT	PAPER CODE
Core Paper-I	Physical Geology and Geodynamics	21UGY01
Core Paper-II	Geomorphology and Structural Geology	21UGY02
Core Paper-III	Palaeontology	21UGY03
Core Paper-IV	Stratigraphy	21UGY04
Core Paper-V	Crystallography	21UGY05
Core Paper-VI	Mineralogy	21UGY06
Core Paper-VII	Igneous Petrology	21UGY07
Core Paper-VIII	Sedimentary and Metamorphic Petrology	21UGY08
Core Paper-IX	Economic Geology	21UGY09
Core Paper-X	Photogeology and Remote Sensing	21UGY10
Core Paper-XI	Mining and Engineering Geology	21UGY11
Core Paper-XII	Hydrogeology and Environmental Geology	21UGY12
Core Practical-I	Structural Geology and Surveying	21UGYP01
Core Practical-II	Palaeontology and Stratigraphy	21UGYP02
Core Practical-III	Crystallography and Mineralogy	21UGYP03
Core Practical-IV	Economic Geology and Petrology	21UGYP04
Skilled Based Elective Courses	List of Courses	
	Mapping Techniques in Geology	21UGYS01
	Gemology and Gemstone Evaluation	21UGYS02
	Field Hydrogeology and Techniques	21UGYS03
	Water Quality Analysis	21UGYS04

	Granite Exploration and Exploitation	21UGYS05
	Geostatistics and Computer Application	21UGYS06
	Remote sensing and GIS	21UGYS07
	Mines and Mineral Legislation of India	21UGYS08
	Introduction to Geoinstrumentation	21UGYS09
	Cartography	21UGYS10
	Geology for Competitive Examination	21UGYS11
	Principles of Surveying	21UGYS12
List of Non major Elective Courses	List of Courses	
	Oceanography	21UGYN01
	Climatology	21UGYN02
	Basic Geochemistry	21UGYN03
	Basic Geophysics	21UGYN04
	Geohazards	21UGYN05
	Groundwater Management and Rainwater Harvesting	21UGYN06

ALLIED GEOLOGY PAPERS FOR B.Sc., GEOGRAPHY (3rd and 4th Semester)

SUBJECT PAPER	PAPER CODE
Allied Geology Paper - I	21UGYA01
Allied Geology Paper- I	21UGYA02
Allied Geology Practical-I	21UGYAP01

B.Sc. APPLIED GEOLOGY
SEMESTER-I
CORE I - PHYSICAL GEOLOGY AND GEODYNAMICS
21UGY01

COURSE OBJECTIVES:

1. Geology is the study of the Earth as a whole.
2. Physical Geology introduces different topics which define geology as a branch of Physical Geology.
3. The teaching and learning methodology involves class lectures, practicals and laboratory demonstrations. To impart knowledge of various tectonic features and their evolution.
4. Understand the formation of continent and ocean and distribution of volcanoes and earthquakes.

PHYSICAL GEOLOGY

UNIT-I

Geology: Scope and Importance, Branches of Geology. Stellar System- Solar System: Planets, Satellites, Asteroids, Meteorites and Comets. Origin of the Earth: Theories of Origin - Nebular, Planetesimal, and Tidal Hypotheses – Earth in the Solar System: Size, Shape, Mass, Density, Rotational and Revolution parameters. Parts of the Earth - Lithosphere, Hydrosphere, Atmosphere, Biosphere and their Composition.

UNIT-II

Age of the Earth: Age determination Methods:- Indirect method: Salinity method, Sedimentation Method, Tree-Ring or Growth rings, Lichenometric Method and Direct Method: Ur-Pb Method, K-Ar Method, Rb-Sr Method, C14 Method, Interior of the Earth: Structure and Composition of Crust, Mantle and Core.

UNIT-III

Earthquake: Definition, Focus, Epicenter. Measurement of Earthquake: Seismograph, Seismogram- Richter's scale, Magnitude, Intensity. Earthquake belts of the world with a special reference to India. Volcanoes: Definition, Types, Causes and Effects, Volcanic Products, Volcanic Landforms, Distribution of Volcanoes, Volcanoes in India

GEODYNAMICS

UNIT-IV

Dynamic Earth: Isostasy, Orogeny and Epeirogeny. Origin and Evolution of Oceans, Geosynclines, Profile of Continental Margins, Island Arcs. Sub-Marine, Topography features, Principles of Geodesy, Neotectonics.

UNIT-V

Continental Drift, Sea floor Spreading Theory and Evidences: Plate Tectonics – Convergent Boundaries, Divergent Boundaries, Transform Boundaries. Oceanic Trenches, Volcanic Arcs, Mid-Ocean Ridges, Paleomagnetism and its application.

TEXT BOOKS:

1. Porter and Skinner (1992), Principles of Physical Geology, John Wiley.
2. Arthur Holmes (1992), Principles of Physical Geology, Vol.1, Chapman and Hall, London
3. Mahabathra, G.B. (1994), Text book of Physical Geology, C.B.S publishers, Delhi.
4. V. Radhakrishnan (1996), General Geology, V.V.P. Publishers, Tuticorin.
5. Parbin Singh (2000), A text book of Engineering and General Geology, S.K. Kataria and sons, Delhi.
6. P.C. Sanjeeva Rao and D. Bhaskara Rao, Text book of Geology 2004, Discovery Publishing House, New Delhi.
7. P.K. Mukerjee (1997), Text book of Geology, World Press.

REFERENCE BOOKS

Porter and Skinner 1992 Principle of Physical Geology, IV John Wiley & sons.

B.Sc. APPLIED GEOLOGY**SEMESTER II****CORE II - GEOMORPHOLOGY AND STRUCTURAL GEOLOGY****21UGY02****COURSE OBJECTIVE:**

1. The dynamic instability of the lithosphere, continuous and discontinuous deformation takes place within the rocks in solid or semi-solid state.
2. To decipher the fundamentals of structures and the underlying physical processes of rock deformation and geotectonics to understand landforms and their evolution.
3. To educate the students about the concept rock deformation.
4. To understand qualitative aspects of brittle and ductile deformation processes, and descriptive analysis.

GEOMORPHOLOGY**UNIT-I**

Meaning - Scope - Geomorphic Processes: Internal and External Processes - Diastrophism and Denudation, Internal Process - Faults, Folds and Cracks, Volcanism and Earthquakes: Types and Distribution. External Processes- Weathering: Physical, Chemical and Biological. Mass Wasting: Soil Creep, Landslide, Rock fall, Rock slip and Mudflow.

UNIT-II

Geological Work of River: Sources of Stream Water – River Profile – Geological work – Methods of river Erosion – Rate of River Erosion – Features of Stream Erosion – Sediment Transport by River, Deposition by River. Drainage Patterns and its types. Major Rivers in India.

Lakes: Description, classification, Origin, Geological function, Distribution and Indian lakes.

Geological Work of Groundwater: Description, Chemical Work of Groundwater,

Deposition by Groundwater, Mechanical work of Groundwater.

Geological Work of Wind: Wind Erosion and its Landforms, Sediment Transport by Wind and its Landforms, Deposition by Wind and its Landforms - Sand Dunes and their Types.

UNIT-III

Geological Work of Glaciers: Glacial Morphology – Types of Glaciers

– Geological Work of Glaciers – Glacial Erosion – Rate of Glacial Erosion – Features of Glacial Erosion – Glacial Transport and Glacial Deposits – Morphological notes on Glacial Deposits.

Geological Work of Sea: Definition of Continental Shelf, Continental Slope, Abyssal Plain, Continental Rise and Sub-Marine Canyons. Marine Erosion and Features of Marine Erosion – Marine Deposition – Coral Reefs. Applied Geomorphology: Application in various fields of Earth Science Mineral Prospecting, Geohydrology, Civil Engineering and Environmental Studies, Geomorphology of India.

STRUCTURAL GEOLOGY

UNIT -IV

Introduction and Scope of Structural Geology. Introduction of Topographical and Geological Map and Map Scale, Outcrop, Configuration of Rocks – Igneous Sedimentary Rocks - Principle of Geological Mapping, Map Reading, Projection Diagrams. Shear Zones: Brittle and Ductile Shear zones, Geometry and Products of Shear Zones; Stress-Strain Relationships for Elastic, Plastic and Viscous Materials. Measurement of Strain in Deformed Rocks. Behaviour of Minerals and Rocks under Deformation Conditions.

UNIT- V

Folds: Definition- Parts of Folds -Types of Folds-Classification of Folds- Recognition of Folds.

Faults: Definition- Types of Faults-Classification of Faults-Recognition of Faults.

Joints: Definition- Types of Joints-Classification of Joints.

Unconformity: Definition-Types-Recognition of Unconformities-Distinguishing Faults from Unconformity. Superposed Deformation. Mechanism of Folding, Faulting and Progressive Deformation. Origin of Lineation and Foliation.

TEXT BOOK:

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 Ed. Wiley Eastern Ltd. New Delhi.
6. Billings, M.P. Structural Geology: Prentice Hall, Englewood Cliffs, U.S.A.

7. Novin, C. M. Principles of structural Geology John Willey, New York.
8. Gokhale, N. W. Theory of Structural Geology, CBS Publishers.

REFERENCE BOOK:

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 Graw Hill, New York.
4. Park, P.G.-Fundamentals of structural Geology, John Willey & Sons.

B.Sc. APPLIED GEOLOGY
SEMESTER II
CORE PRACTICAL I - STRUCTURAL GEOLOGY AND SURVEYING
21UGYP01

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 superposition – 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.

Determination of true dip & apparent dip and thickness by calculation and graphical method.

Description of features in Survey of India's (SOI) Topo sheet: Extra marginal, marginal, intra marginal information, major conventional signs and symbols, physical and socio-cultural features.

SURVEYING

Chain surveying: Open traverse and closed traverse. Prismatic compass surveying: Determination of the distance between two inaccessible stations. Radiation method, method of Intersection – Plane table surveying: Determination of the distance between two inaccessible stations. Radiation method, method of Intersection – Leveling: Rise and fall method -Clinometer Compass and Brunton Compass: To find out dip and strike of the beds. GPS: Fundamentals and applications.

**B.SC. APPLIED GEOLOGY
SEMESTER-III
CORE III - PALAEONTOLOGY
21UGY03**

COURSE OBJECTIVES:

1. To make the participant to acquire knowledge on ancient life, skills on identification and documentation of paleontology.
2. The knowledge in palaeontology is to equip the students for understanding.
3. To educate various aspects biological events such as origin of life, evolution, mass extinctions, radiations, paleo-ecology, exceptional preservation, and functional morphology.
4. To prepare the students for professional job perspective in the field of basic palaeontological research, to benefit them in the preparation of various exam.

UNIT-I

Definition of Palaeontology – Scope of Paleontology- Geological Time Scale. Definition of fossils – Types of fossils - Nature and Modes of Preservation of fossils: Body fossils and Unaltered hard parts, Altered hard parts, Petrification, Permineralisation, Carbonization, Mould and Casts, Tracks, Trails, Borings. Uses of fossils – Stratigraphic Indicators – Climatic Indicators- Indicators of Paleogeography
Indicators of Evolution and Migration of life forms – Indicators of New deposits of Coal and Petroleum – Life through ages. Significance of Fossils- Introduction to Chronostratigraphy - Lithostratigraphy – Biostratigraphy.

UNIT-II

Invertebrate Palaeontology: Phylum Mollusca: Class **Pelecypoda** - General morphology – Dentition type - Shell form - Ornamentation, Classification, Geological history. Class **Gastropoda**: General morphology - Types of coiling – Dextral and Sinistral – Shell form- Ornamentation, Classification, Geological history. Class **Cephalopoda**: Sub Class: Nautiloidea, Ammonoidea - General morphology - Patterns: Nautilitic, Goniatitic, Ceratitic and Ammonitic – Shell forms – Ornamentation – Classification, Geological history and Coleoidea – Morphology and Geological history of a Belemnite shell.

UNIT -III

Phylum Arthropoda: Class – **Trilobita**- General Morphology: Classification Geological history and. Phylum Porifera – A short account of sponges.
Phylum **Coelentrata** – Class **Anthozoa** – General Morphology- Shapes of Corals - Classification – Geological distribution.
Phylum **Hemichordata** – Class **Graptozoa** – General Morphology, Classification, Geological distribution.

UNIT- IV

Phylum Brachiopoda: General morphology – Shell forms - Ornamentation, Classification, Geological history Distinguish between Lamellibranches and Brachiopods.

Phylum Echinodermata: Class **Echinoidea:** General morphology: Periproct, Corona, Peristome. Classification – Regular and Irregular Echinoids and Geological history. Class

Crinoidea- Morphology- Geological history. Class **Blastoidea-**Morphology- Geological history.

UNIT-V

Phylum Protozoa –Class **Sarcodina:** Order **Foraminifera:** General morphology – Dimorphism-Forms of Foraminiferal tests - Ornamentation- Geological history.

Phylum Arthropoda - Class **Crustacea:** Sub-Class: **Ostracoda** – Morphology – Classification and Geological history.

Vertebrate Palaeontology: Classification of Animal kingdom - Habitats and Habits of animals-A brief outline of the Classification of Vertebrates – Evolution of Fishes, Horses, Elephants and Man. Dinosaurs – Evolution and Extinction of Dinosaurs.

Paleobotany: General classification of Plant kingdom – Gondwana Indian Plant fossils – A brief account of the following Plant fossils: Glossopteris, Gangamopteris, Ptilophyllum, Calamites, Lepidodendron and Sigillaria. Introduction to Spores and Pollens. Significance and Paleoclimatic conditions of Gondwana flora.Applications of Micropalaeontology.

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, Harperbrothers
 3. Shrock, R.R. and Twenhofel, W.H. (1953), Principles of invertebrate Palaeontology, Arnold publication Easton.
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**B.Sc. APPLIED GEOLOGY
SEMESTER-IV
CORE IV – STRATIGRAPHY
21UGY04**

COURSE OBJECTIVE:

1. To understand basic knowledge about Indian Stratigraphy.
2. To train the students to understand the processes of formations of timescale stratigraphy and significance of fossils.

UNIT-I

Stratigraphy-Definition-Principles of Stratigraphy: Law of Superposition, Uniformitarianism, Faunal succession, Correlation and Contemporaneous. Geological Timescale and their Divisions. Stratigraphic Unit. Homotaxis, Homotaxial and Synchronous Beds. Physiographic divisions of India,

UNIT- II

Precambrian Stratigraphy: Archean of Dharwar Province, Archean of Singhbhum - Orissa, Archean of Eastern Ghats, Archean of Aravalli, Archean of TamilNadu – Sathyamangalam Group, Bhavani Gneissic Complex, Anorthosite Complex. Mineral Wealth of Archean India, The Ep-archean unconformity, Stratigraphy of Cuddapah -Economic minerals of Cuddapah System and Vindhyan System – Kurnool Group– Economic minerals of Vindhyan System.

UNIT- III

Palaeozoic Stratigraphy: Distribution of Palaeozoic rocks in India, Cambrian, Carboniferous and Permian of Salt Range, Palaeozoic of Kashmir Valley. Palaeozoic of Spiti Valley and Paleozoic rocks of Peninsular India.

UNIT- IV

Mesozoic Stratigraphy: Importance of Gondwana Super Group and Gondwana Plant beds in Tamilnadu. Triassic of Spiti, Kashmir- Salt range-Jurassic of Cutch, Cretaceous of Tiruchirappalli and Narmada Valley–Thiruvakkarai Wood Fossil, Pondicherry. Age of Deccan traps – Bagh Beds – Lameta Beds.

UNIT- V

Cenozoic Stratigraphy: Geological Event during Cenozoic Era, Rise of Himalaya, Neogene of Siwalik System. Tertiary of Assam-Karewa formation, Tertiary rocks of Tamil Nadu - Cuddalore Sandstone, Importance of Sivapithecus, Ramapithecus Apes. Pleistocene Glaciations - Mineral Wealth of Tertiary rocks of India.

TEXT BOOKS

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.
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**B.Sc. APPLIED GEOLOGY
SEMESTER-IV
CORE PRACTICAL PAPER-II
PALAEONTOLOGY AND STRATIGRAPHY-
21UGYP02**

PALAEONTOLOGY

Megascopic identification and description of the following fossils:

Pelecypoda: Arca, Meretrix, Pecten, Cardita, Alectryonia, Spondylus, Inoceramas, Gryphaea, Exogyra, Radiolites, Ostrea, Unio, Venus, Cardium.

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. **Echinodermata:** Pentrimites, Cidaris, Hemidaris, Micraster, Holaster, Hemiaster, Stygmatothyris.

Arthropoda: Trilobites: Paradoxides, Calymene, Phacops. Trinucleus. **Brachiopoda:** Spirifer, Productus, Terebratulina, Rhynchonella, Atrypa, Athyris, Orthis.

Graptolites: Phyllograptus, Tetragraptus, Didymograptus, Diplograptus, Monograptus.

Corals: Calceola, Zaphrentis, Favosites, Halysites.

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.

STRATIGRAPHY

Stratigraphy - Arranging the different Indian Stratigraphic horizons in accordance with age, Stratigraphic position, Fossil content and Order of Superposition.

B.Sc. APPLIED GEOLOGY
SEMESTER-V
CORE V – CRYSTALLOGRAPHY
21UGY05

COURSE OBJECTIVE:

1. The course's specific aim is to acquaint students about Crystal structures and their classification into unit systems and symmetry classes.
2. To acquaint students about various laws of crystallography governing the consistency of Crystal structures with respect to specific chemical composition. 3. To introduce how do minerals form. To explain chemical composition, bonding and internal structure of minerals.

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. Symmetry in General - Planes of Symmetry - Axes of Symmetry - Centre of Symmetry – Relation of Geometrical to Crystallographic symmetry - Pseudo symmetry - Crystallographic axes - Systems of crystallization.

UNIT- II

Crystals Forms-Introduction of Holohedral, Hemihedral, Hemimorphic and Enantiomorphic.

Isometric System: Normal, Pyritohedral, Tetrahedral, Plagiohedral classes with references to well-developed crystals of Galena, Spinel, Garnet, Fluorite, Diamond, Pyrite, Tetrahedrite, Boracite, and Cuprite.

Tetragonal System: Normal, Hemimorphic, Tripyramidal, Pyramidal - Hemimorphic, Sphenoidal, Trapezohedral, Tetrahedral classes with references to well-developed crystals of Zircon, Rutile, Cassiterite, Vesuvianite, Apophyllite, Shellie, Melonite, Wulfenite and Chalcopyrite.

UNIT- III

Hexagonal System: Hexagonal Division: Normal, Hemimorphic, Tripyramidal, Pyramidal, Hemimorphic, Trapezohedral classes with references to well-developed crystals: Beryl, Zincite, Apatite, Calcite, Corundum, Tourmaline, Phenacite and Quartz. Rhombohedral Division: Rhombohedra, Rhombohedral-hemimorphic, Trirhombohedral, Trapezohedral classes.

UNIT-IV

Orthorhombic System: Study of the Symmetry elements, Forms and typical minerals of Normal, Hemimorphic and Sphenoidal classes with special reference to well-developed crystals of Barite, Olivine, Topaz, Staurolite, Sulphur, Calamine, Struvite and Epsomite.

Monoclinic System: Study of the Symmetry elements and Forms of the Normal class.

Triclinic System: Study of the Symmetry elements and Forms of the Normal class.

UNIT- V

Twinning : Definition – Evidence of Twinning- Laws of Twinning- Composition plane- Twinning plane - Twinning axis –Types of twinning - Simple Repeated (Polysynthetic) Contact and Penetration twinning – Secondary Twinning .

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, HarperBros (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 Minerology, 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.
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**B.Sc. APPLIED GEOLOGY
SEMESTER-V
CORE VI –MINERALOGY
21UGY06**

COURSE OBJECTIVES:

1. To study the physical chemical and optical properties of rock forming minerals. The course will lay the foundation for the broader understanding of the geology by imparting the basic knowledge about the rock forming minerals.
2. To learn about minerals their formation, complexity, association, identification of the basic idea of mineral interaction.

UNIT- I

Definition of Mineral and Mineraloid, Scope of Mineralogy, Properties of minerals: Physical, Chemical, Optical.

Physical Properties of minerals: Based on cohesion: Form, structure, Cleavage, Hardness, Fracture, Tenacity, Specific gravity. Jolly balance and beam balance.

Based on Light: Colour, Streak, Lustre, Transparency, Fluorescence, Phosphorescence.

Based on Heat: Electricity, and Magnetism.

Based on Senses: Taste, Odour, feel.

Chemical Properties of minerals: Isomorphism, Polymorphism and Pseudomorphism.

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 Group:** Description, General Characteristics, Crystalline Varieties, Cryptocrystalline Varieties, Amorphous Varieties.

Feldspar Group: Introduction, Crystal System.

Alkali Feldspar: Orthoclase, Microcline, Perthite.

Plagioclase Feldspar: Plagioclase Series.

UNIT- III

Mineralogy, Structure, Chemical composition, Optical and Physical properties, Modes of Occurrence and Industrial uses of the following group of minerals: **Feldspathoid Group:** Leucite, Nepheline, Cancrinite, Sodalite, Hauynite, Noselite, Lazurite.

Pyroxene Group: Orthopyroxene, Clinopyroxene, Clinoenstatites, Pigeonite, Diopside-Hedenbergite, Augite, Wollastonite, Aegirite, Jadeite, Spodumene, Rhodonite.

UNIT-IV

Mineralogy, Structure, Chemical composition, Optical and Physical Properties, Modes of occurrence and Industrial uses of the following group of minerals: **Amphibole Group:** Anthophyllite, Cumingtonite, Tremolite, Actinolite, Hornblende, Barkevekeite, Glaucophane, Ribbeckite, Arfvedsonite.

Mineralogy, Structure, Chemical composition, Optical and Physical Properties, Modes of occurrence and Industrial uses of the following group of minerals: Olivine Group, Mica group, Garnet Group and Zeolite Group.

UNIT- V

Optical Mineralogy: Optical system-light –ordinary light, polarised light. The parts of Polarizing Microscope. Refraction: Snell's law. Optical properties of minerals: Refractive index (RI) Dispersion-total reflection-birefringence, Isotropic and Anisotropic, Double Refraction, Uniaxial and Biaxial Minerals, Optical Indicators- Optic axis –Optical sign.

TEXT AND REFERENCE BOOKS:

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 Publishers, New York.
4. Erni, H. (2010), Mineralogy Simplified, Forgotten Books Publishers, London, 436
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.
7. Paul F. Kerr (1984), Optical Mineralogy, Mc Graw-hill book company New York.

B.Sc. APPLIED GEOLOGY
SEMESTER-V
CORE VII - IGNEOUS PETROLOGY
21UGY07

COURSE OBJECTIVE:

1. To understand characteristics and genesis of Igneous rocks.
2. To understand igneous processes, physical and chemical characteristics of magma and various rock types its geological setting, petrogenesis, classification, and natural characteristics, textures and structures.
3. To identify mineral assemblages, textural and chemical composition of mineral.

UNIT-I

Introduction to Petrology – Igneous Rocks-Magma- Definition, Types and Origin: Basaltic, Andesitic, Rhyolitic magma –Rock Cycle - Plutonic, Hypabyssal and Volcanic rocks formation - Composition and Constitution of magma- Primary and Parental magma. Forms of Intrusive igneous rocks: Concordant and Discordant forms-Forms of Extrusive igneous rocks.

UNIT -II

Textures: Definition -Types: Crystallinity, Crystallites, Microlites, Devitrification, Granularity.

Shape of Crystals – Equigranular Texture: Allotriomorphic, Hypidiomorphic, Panidiomorphic, Microgranular, Orthophyric, Felsitic texture. Inequigranular Texture: Porphyritic, Poikilitic, Ophitic, Intergrowth, Directive overgrowth, Reaction texture. Structures: Definition- Types: Vesicular and Amygdaloidal, Blocky lava, Ropy lava, Pillow structure, Flow structure, Sheet joints, Mural joints, Columnar joints, Rift and Grain, Reaction Rims, Xenolithic structure.

UNIT- III

Physical properties of magma: Crystallization of Unicomponent magma- Binary magma: (Di-An) Eutectic system, (Al-An) Solid solution system – Ternary system (Ab-An-Di). Bowen reaction series, Diversity of Igneous rocks – Magmatic differentiation: Fractional crystallisation, Liquid immiscibility, Assimilation.

UNIT- IV

Classification of Igneous Rocks: CIPW classification, Mineralogical classification, Megascopic (or) field classification, Tyrrell tabular classification, - Classification based on the Alkali to Plagioclase feldspar.

UNIT- V

Petrography and Petrogenesis of the following Acid and Intermediate rocks: Granite, Granodiorite, Syenite, Diorite, Rhyolite, Dacite, Trachyte, Andesite, Pegmatite and Aplite. Basic, Ultrabasic and Ultramafic rocks: Gabbro, Dolerite, Basalt – Monomineralic rocks: Dunite, Pyroxenite, Anorthosite.

TEXT AND REFERENCE BOOKS

1. Tyrrell, 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, F.W. (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,
 7. Johannesen, A (1962) Descriptive petrography of Igneous Rock.
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B.Sc. APPLIED GEOLOGY**SEMESTER-V****CORE-VIII SEDIMENTARY AND METAMORPHIC PETROLOGY****21UGY08****COURSE OBJECTIVE:**

1. To impart knowledge of formation of sedimentary rocks.
2. To train the students to understand the mode of formations, transportation and deposition of the sediments and also about the processes modifying the sediments after their burial.
3. To infer the metamorphic agents, kinds and formation of metamorphic rocks.
4. To understand implications of various physico-chemical parameters in formulating metamorphic history of rocks

SEDIMENTARY PETROLOGY**UNIT-I**

Sedimentary Formation: Description and formation of Sedimentary Rocks- Mechanical deposits, Chemical deposits, Organic deposits and Pelitic deposits **Environmental Formation:** Facies-Continental-Transitional-Marine. Sedimentary Process: Weathering-Disintegration and Decomposition, Erosion, Transportation, Deposition, Lithification and Diagenesis.

UNIT- II

Sedimentary Classifications: Brief study of F.J. Pettijhon and Tyrrell classification of sedimentary rocks into Residual, Mechanical, Chemical and Organic deposits. **Textures of Sedimentary Rocks:** Origin of grains, Size, Shape, Packing, Fabric and Crystallization of grains. **Structures of Sedimentary Rocks:** Mechanical, Chemical, Organic.

UNIT- III

Petrographic details of important Silicic and Carbonate rocks such as- Conglomerate, Breccia, Shale, Sandstone, Clay, Limestone, Dolomite, Coal-Iron ores of Sedimentary Origin-Gypsum-Rocksalt-Flint-Chert and Phyllite. Sedimentary Basins of India and Tamilnadu.

METAMORPHIC PETROLOGY**UNIT- IV**

Definition, Agents and Kinds of Metamorphism –Metamorphic Grade, Zone, Facies. Textures and Structures of Metamorphism. Classification of Metamorphic Rocks. Cataclastic Metamorphism and its Products. Retrograde Metamorphism. Thermal Metamorphism of Pelitic Sediments, Pure and Impure Calcareous rocks. A brief study of Gneiss, Mylonite, Hornfels, Marble, Ophiolite.

UNIT- V

Dynamo Thermal Metamorphism of Pelitic Sediments. Plutonic Metamorphism. Petrography and Origin of Charnockites – Metamorphic Differentiation –Pneumatolytic Injection Metamorphism – Anataxis and Palingenesis. Brief study of Slate, Phyllite, Quartzite, Schist. Gneiss, Granulite, Leptynite, Charnockite, Eclogite, Amphibolite, Schorl, Adirondite, Lit- Par- Lit – gneiss and Migmatite.

TEXT AND REFERENCE BOOKS

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

B.SC. APPLIED GEOLOGY**SEMESTER-VI****CORE IX - ECONOMIC GEOLOGY****21UGY09****COURSE OBJECTIVES:**

1. To study mineral deposits and processes of formation of deposits and the nature of different mineral deposits, its genesis and distribution of major ore minerals.
2. To understand the genetic controls of physical and chemical processes of ore formation in various geological settings.
3. To provide the knowledge on geological processes responsible for mineral and ore formation, weathering and other secondary mineralization processes.
4. To familiarize mode of occurrence of economic minerals, metallic and non-metallic minerals.

UNIT-I

Economic Geology -Definition and Scope. Concept of Ore minerals, Gangue minerals. Tenor, Grade and Ores. Classification of Mineral Deposits. Outline of Lindgren's and Bateman's Classifications. 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– 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, Ore 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-Concentration Process and Deposits – Mechanical Concentration Principles – Eluvial, Alluvial, Beach and Aeolian placers. 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

Mineral Resources of India– Ore mineralogy, Association, Genesis, Modes of occurrence, origin and Indian Distribution of the following Metallic Ore Deposits-Copper, Gold, Silver, Uranium, Thorium, Beryllium, Zirconium, Tin, Lead and Zinc.

UNIT- V

Mineralogy, mode of occurrences, uses and distribution in India of the following Metalliferous deposits –Iron, Manganese, Molybdenum, Titanium, Aluminum, Chromium. Refractory minerals, Industrial minerals, Abrasive minerals, Ceramic mineral and Fertilizer, Pigments minerals. 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.

Mineral Economics: Concepts-Strategic-Critical and Essential Minerals- Demand and supply – Mineral Conservation and substitution. Outline of National Mineral Policy (NMP) and Mineral Concession Rules. (MCR).

TEXT AND REFERENCE BOOKS

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

**B.Sc APPLIED GEOLOGY
SEMESTER-VI
CORE X - PHOTOGEOLOGY AND REMOTE SENSING
21UGY10**

COURSE OBJECTIVE:

1. To understand the aerial photography and Preparation of Photo-geologic Maps. Mosaic controlling factors of aerial photograph.
2. To know about Electro-Magnetic Spectrum, Space platforms and Elementary idea about active and passive sensors.
3. Application of photo-geology and remote sensing in geological studies.
4. To impart knowledge of environmental geology, natural hazards and basic concepts of remote sensing and GIS.

PHOTOGEOLOGY

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 scanings. Types of Resolution – Data Acquisition and Interpretation.

REMOTE SENSING

UNIT -IV

Aerial Photography: Types of Aerial Photographs, Geometry of Aerial Photographs: Oblique, Vertical and Stereopair. Scale of Photograph: Determination of Scale-relief displacement – Stereoscopes-Parallax bar.

UNIT-V

Thermal Remote Sensing: Thermal Radiation Principles – Atmospheric Windows – Advantages and Disadvantages. SLAR – Principle and Applications. A short account of LANDSAT, SPOT, India Remote Sensing Satellites and Indian Space Missions.

TEXT AND REFERENCE BOOKS

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. Gupta, R.P. (2003), Remote Sensing Geology, Springer, New Delhi.
 8. Lillisand, T.M. & R.W. Kiefer (2000), Remote Sensing and Image Interpretation, Wiley.
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B.SC. APPLIED GEOLOGY**SEMESTER-VI****CORE XI - MINING AND ENGINEERING GEOLOGY****21UGY11****COURSE OBJECTIVES:**

1. To understand the basic fundamental concepts of various mining methods, their terminologies, and the type of sampling adopted, explosives used in the mine, and to have a basic knowledge about mine machineries.
2. To provide the knowledge of geological investigation for site selection of engineering projects.
3. To understand the rock type and their engineering properties, suitability of site conditions for Dam, tunnel, roads and highways.
4. To develop concept and applied aspect of geology in various civil or geo engineering projects.

MINING GEOLOGY**UNIT- I**

Sampling-Principles - Types- Collection of sample-Core Sample and their Preservation. Mining Terminology: Exploitation-Development-Shaft, Level, Adit, Hanging Wall, Foot wall, Drive, Cross-Cut, Tunnel, Raise, Winze and Chute. **Drilling:** Percussion-Rotary-Miscellaneous drilling methods-Geological Logging of Borehole samples. **Methods of breaking rocks – Explosives:** Low, High, Sheathed, Permitted, Liquid Oxygen and Miscellaneous.

UNIT- II

Mining Methods: Opencast Mining- Loading by Manual, Machines, Glory Hole and Kaoline Mining. **Underground Mining:** Stoping-Open stopes, Overhand: Timbered, Filled, Shrinkage, Mitchell Slicing System and Caving Methods.

UNIT-III

Alluvial Mining – Pan and Batea-Rocker-Longtom-Sluicing-Derrick and Cableway -
Hydraulicking-Drift and Dredging. **Coal Mining:** Pillar methods- Longwall advancing-
Longwall retreating-Horizon mining and Miscellaneous: Underground hydraulic mining -
Strip mining.

ENGINEERING GEOLOGY**UNIT-IV**

Introduction to Engineering Geology: Scope, Engineering properties of rocks, Rock
Discontinuity. Physical characters of Building, Decorative stones and Concrete aggregates
and Road materials.

Soils-Physical and Engineering Properties. Soil Formation, Profile and Classification. Soil
erosion and Its control. An account on Soil Group of India..

Dams: Definition, Types, Geological conditions, Site investigations and Dam foundations.
A short note on important Indian Dams.

Reservoirs - Definition, Selection of Reservoir sites and Groundwater conditions.
Problems in Reservoirs: Sedimentations, Slope control, Leakage and Seismicity. Short
account of Indian and Tamilnadu reservoirs.

UNIT- V

Tunnels - Definition, Parts of a Tunnel, Tunneling in hard and soft rocks, Geological
investigation and Ground water conditions.

Roads- Complicated regions for Roads, Geological problems after road construction.
Improvement of Sites- Soil stabilization.

Foundations-Definition, Geological investigations and groundwater problems.

Landslides-Definition, Slope stability, Slope failure and Safety. Slope Control, Geological
factors, Groundwater conditions and Remedial measures.

Mass Movements-Causes, Types, Monitoring and Controls of mass movements.

TEXT 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.
6. REFERENCE BOOKS
7. Bell, F.G. (2005), Fundamentals of Engineering Geology, B.S. Publications
Hyderabad.
8. Krynine, P.D. & W.R. Judd (1956), Principles of Engineering Geology & Geotechnics,
CBS, Delhi.
9. Legget, R.F. & A.W. Hatheway (1988), Geology and Engineering. 3rd Ed. McGraw
Hill, New York.

B.SC. APPLIED GEOLOGY
SEMESTER-VI
CORE XII - HYDROGEOLOGY AND ENVIRONMENTAL GEOLOGY
21UGY12

COURSE OBJECTIVE:

1. To impart knowledge of basic hydrogeology including groundwater origin, occurrence and distribution.
2. To train students on basics of well hydraulics, method of exploration, water budget and management.
3. To impart theoretical, practical and field knowledge pertaining to Hydrogeological domain.
4. To understand the relationship in between water and rock interaction and salt water intrusion and its remedial measures in the coastal aquifers.

HYDROGEOLOGY

UNIT-I

Definition of Hydrology and Hydrogeology – Hydrological cycle -Origin of Groundwater- Water bearing formations: Aquifers, Aquiclude, Aquifuge and Aquitards. Types of Aquifers: Unconfined, Semi-confined, Confined and Perched – Vertical distribution of groundwater – **Springs:** Types, Geological conditions favoring development of springs. Artesian wells and Piezometric surface. Rock properties affecting groundwater. Types of Openings, Porosity, Specific yield, Specific retention and Permeability. Determination of permeability in field and lab. Groundwater movement – Darcy's law and its applications – Groundwater occurrence in Igneous, Sedimentary and Metamorphic rocks.

UNIT-II

Groundwater investigation-Electrical Resistivity Methods: Wenner's and Schlumberger's electrode arrangements. **Wells:** Outline of Dug wells, Tube wells, Jetted wells, Infiltration galleries and Collector wells – Well design and development– Fluctuations of groundwater – Groundwater recharge methods. Suitability for drinking and irrigation purposes – Seawater intrusion: Causes, Consequences and Preventive and Control measures.

UNIT-III

Groundwater Quality: Analysis of p^H -TDS-TSS-Specific Conductance- Hardness- Mineral characteristics-Expression of Analysis: Cations, Anions. Groundwater resources of Tamilnadu including its quality. The latest drinking and irrigation water standards of WHO and BIS – Waterborne diseases. Groundwater Recharge:- Recharge Methods - Basin method, Stream channel method, Ditch or Furrow method, Flooding method, Irrigation method, Pit method and Recharge well method. Rainwater Harvesting Systems.

ENVIRONMENTAL GEOLOGY

UNIT- IV

Introduction to Environmental Sciences-A brief account of Energy System.

Classification of Natural Resources -Renewable and Non-Renewable resources.

Water Resources: Surface and Groundwater-Uses and Exploitation. Flood, Drought, Dams, Benefits and Problems.

Mineral Resources: Resource and Exploitation, Effects of Extraction on Environment.

Land Resources: Land as a resource, Land degradation, Man induced landslides, Soil erosion and Desertification. Role of Individual in Conservation Natural Resources, Equitable use of resources for sustainable lifestyle.

UNIT- V

Ecosystem: Concept of an ecosystem, Structure and function of an ecosystem. Forest, Grassland, Desert, Aquatic Ecosystem. Cause, effects and control measures of Water pollution, Air pollution and Mine pollution- Marine pollution- Noise pollution. Cause, Effects and Control measures of Thermal pollution- Nuclear hazards- Solid and Radioactive waste management. Role of individual in prevention of pollution. Disaster Management: Floods, Earthquakes, Landslides and Soil erosion.

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. Ragunath, H.M. (2007), Groundwater, New Age International Publishers, Delhi
4. Karanath, K.R. (1987), Groundwater Assessment, Development & Management, Tata McGraw Hill.
5. Ramakrishnan, S. (1998), Groundwater, K.G. Graph Arts, Chennai.
6. REFERENCES BOOKS
7. Valdiya, K.S (1987), Environmental Geology – Indian Context. Tata McGraw-Hill., Delhi.
8. Kellar, E.A. (1979), Environmental Geology, Charles. Merrill Publishing Co. Ohio.
9. Lundgren, I. (1986), Environmental Geology, Prentice Hall.

B.Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE PRACTICAL - III CRYSTALLOGRAPHY AND MINERALOGY

21UGYP03

CRYSTALLOGRAPHY

Description of forms present and determination of Miller indices of the following:
CRYSTAL MODELS:

Isometric System: Normal Class – Galena, Fluorite, Magnetite, Garnet, and Leucite, Copper-Pyritohedral class – Pyrite, Tetrahedral Class – Tetrahedrite.

Tetragonal System: Normal Class – Zircon, Vesuvianite, Cassiterite, and Rutile. Tripyramidal – Scheelite, Meionite Sphenoidal Class – Chalcopyrite.

Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite, Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz.

Orthorhombic System: Normal – Barite, Sulphur, Stibnite, Topaz, Staurolite, and Aragonite. Hemimorphic – Calymene, Sphenoidal Class – Epsomite.

Monoclinic System: Normal – Gypsum, Pyroxenes and Amphiboles.

Triclinic System: Normal – Axinite, Albite, and Rhodonite.

Twin Crystals: Contact and Penetration twins of Fluorite, Iron Cross Twin of Pyrite, Knee type twin of Cassiterite, Polysynthetic twin of Aragonite, Cyclic twin of Cerussite, Swallow Tail of Gypsum, Twins of Carlsbad, Baveno, Manebach, Albite law of Albite.

MINERALOGY

Megascopic identification and description of the following:

Quartz Group: Quartz, Chalcedony, Opal, Agate, Flint, Jasper, Amethyst, Rosequartz, Chert.

Feldspar Group: Orthoclase, Microcline, Albite, Oligoclase, Labradorite. **Feldspathoid Group:** Adularia, Sanidine, Nepheline, Sodalite, Ilmenite. **Pyroxene Group:** Enstatite, Bronzite, Hypersthene, Augite.

Amphibole Group: Hornblende, Actinolite, Tremolite.

Olivine Group: Olivine, Serpentine.

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

Other Minerals: Chlorite, Epidote, Garnet, Apophyllite, Stilbite, Heulandite, Talc, Steatite, Beryl, Kaolin, Cordierite, Apatite, Andalusite, Staurolite, Sillimanite, kyanite, Tourmaline, Topaz, Calcite, Dolomite Fluorspar.

Optical Mineralogy:

Microscopic identification and description of the following: Quartz, Orthoclase, Albite, Oligoclase, Andesine, Labradorite, Anorthite, Nepheline, leucite, Sodalite, Hypersthene, Augite, Diopside, Aegirine, Hornblende, Tremolite, Actinolite, Glaucophane, Riebeckite, Muscovite, Biotite, Phlogopite, Olivine, Serpentine, Chlorite, Epidote, Garnet, Apatite, Zircon, Spinel, Magnetite, Tourmaline, Calcite, Dolomite, Andalusite, Staurolite, Sillimanite and Cordierite

Geochemistry:

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

B.Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE PRACTICAL PAPER – IV ECONOMIC GEOLOGY AND PETROLOGY

21UGYP04

ECONOMIC GEOLOGY

Industrial Minerals:

Megascopic identification and description, Indian occurrences and uses of the following:

Magnesite, Gypsum, Asbestos, Fluorite, Calcite, Graphite, Barite, Talc, Witherite, Strontianite, Anhydrite, Bauxite, Halite, Dolomite, Aragonite, Kaolin, Garnet, Corundum, Phosphate Nodule, Coal and its varieties.

Fe Ores: Magnetite, Hematite, Limonite, Pyrite, Marcasite and Siderite.

Cu Ores: Chalcopyrite, Cuprite, Bornite, Malachite, Azurite, Native Copper.

Mn Ores: Pyrolusite, Psilomelane, Rhodochrosite, and Rhodonite.

Pb Ores: Galena, Cerussite, Anglesite.

Zn Ores: Smithsonite, Sphalerite.

Sn Ore: Cassiterite.

As and Sb Ores: Realgar, Orpiment, Stibnite.

Miscellaneous Ores: Wolframite, Molybdenite, Bauxite, Chromite, Ilmenite, Rutile, Cinnabar.

Radioactive Ores: Monazite, Zircon, Pitchblende, and Pyrochlore.

PETROLOGY

Megascopic identification of the following rocks:

IGNEOUS 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.

SEDIMENTARY ROCKS:

Conglomerate, Breccia, Sandstone, Arkose, Shale, Shelly Limestone, Laterite, Peat, Lignite.

METAMORPHIC ROCKS:

Slate, Phyllite, Schists, Gneisses, Quartzite, Marble, Amphibolite, Eclogite, Leptynite, Charnockite, Khondalite, and Basic Granulite.

Microscopic identification and description of the following rocks:

IGNEOUS 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.

SEDIMENTARY ROCKS:

Conglomerate, Breccia, Sandstone, Arkose, Shale, Shelly Limestone.

METAMORPHIC ROCKS:

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.

B.SC. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSES PAPER I
MAPPING TECHNIQUES IN GEOLOGY
21UGYS01

COURSE OBJECTIVE:

1. To impart knowledge of geological field survey.
2. To train the students to understand functioning of necessary instruments required during geological field survey.

UNIT- I

Definition and Scope of Mapping in Geology. Geologic Field Notes: Field Equipments: Clinometer and Brunton Compass - Geological Hammer - Pocket lens –Streak plate– Hand magnet – Measuring tape.

UNIT- II

Field Observations – Measuring Attitudes of Structural features: Dip and Strike of beds - Fold- Fault- Unconformity- Foliation – Lineation – Joints.

UNIT- III

Topographic Maps: Definition of Topography- Parts of Topographic map – Features represented, Map Enlargement, Reduction and Preparation of Base map – Height / elevation datum in topographic maps.

UNIT- IV

Introduction to Scale in Topographic Maps – Aerial Photographs. Global Positioning System (GPS) - Estimating location and Relative Height. Preparation of Geological Maps and its Interpretation.

UNIT- V

Sampling and Collection – Minerals, rocks, fossils. Geological Report – CrossSection – order of superposition.

REFERENCE BOOKS

1. Compton, R.R. (1962), Manual of Field Geology, Wiley, New York
2. Mathur, S.M. (2001), Guides to Field Geology, Prentice Hall of India, Delhi.
3. Freeman,
3. T. (1999), Procedures in Field geology, Blackwell science Oxford, U.K. 4. Dutro, T.J.(1989), AGI data sheet, American Geological institute, Alexandria Virginia U.S.
4. Lahee, F.H. (1961), Field Geology, CBS, Delhi.
5. Davis, G.H. (1985), Structural Geology of rocks and regions, Wiley, New York.
6. McClay, (1995), Mapping of Geological Structures, Geological Soc. Publication House Barth, U.K.

B.SC. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSE PAPER II
GEMMOLOGY AND GEMSTONE EVALUATION 21UGYS02

COURSE OBJECTIVES:

1. To learn and to examine the nature, quality, rarity of gemstones. To understand the physical and optical properties of gemstones.
2. To summarize the origin, classification of gems.
3. To give an idea about the gem testing instruments.
4. To gain knowledge and to provide skills to become a successful gemologist.

UNIT- I

Definition and Scope of Gemmology – Minerals as Gemstones – Classification of Gemstones – Characteristic and Desirable Features of Gemstones. Basic Physical and Optical properties of Gemstones– Optical Classification of Gemstones.

UNIT- II

Gem Testing: Introduction to Gem Mineral Equipment and Instruments: Polarizer – Refractometer – Pycnometer – Use of Heavy liquids. Non-destructive methods in gem Identification. Gem Simulants and Proxies. Artificial Gemstones and Substitutes.

UNIT- III

Gemstone Cutting: Cutting Instruments: Diamond Saw – Blade. Preliminary Observations – Rough Cutting of Gemstones – Sizing and Shaping of Raw stones – Styles of Cutting: Rounding, Cabochon, Flat, Square, Rectangle, Crown, Brilliant, and Laser Sculpting.

UNIT- IV

Weight Standard Schemes used in Gemology – 4Cs Scheme for Diamonds. Polishing of Gemstones – Polishing Angles and limits. Polishing Equipments. Feasibility and Economics of Gem Industries in India with special reference to TamilNadu. Grading, Valuation and Pricing of Gems.

UNIT- V

Gemstone Prospecting: Host rocks – Gemstone Mineralization – Deposits. Exploration Techniques and Exploitation. Gemstone Occurrences in India and with special references to Tamil Nadu.

REFERENCE AND TEXT BOOKS

1. Karanth, K.V. (2000), Gem and gem industry in India, Memoir 45, Geological Society of India, Bangalore.
2. Anderson, B.W. (1990), Gem testing (10th edition), Butterworth Scientific, London. Babu, T.M. (1998), Diamonds in India, Geological Society of India, Bangalore.
3. Hall, C. (1994), Gemstone, Dorling Kindesley, London, Deer, W.A., Hurre, R.,

4. Aabdzussman, S. (1992), An introduction to rock forming minerals, ELBS, London.
Kerr, P.F. (1997), Optical mineralogy, 4th Ed. McGraw Hill Book & Co New York.
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**B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSE PAPER IV
WATER QUALITY ANALYSIS
21UGYS04**

COURSE OBJECTIVES:

1. To impart knowledge of basic water quality analysis.
2. To train students on basics of laboratory methods using quality of water.
3. Study about Recycling of water, Water borne diseases, Reverse Osmosis (RO) System and Desalination of water.

UNIT- I

Physical Properties of Water: Color, Odor, Taste, Temperature, Turbidity and Viscosity. Methods of Analysis of Physical Properties. World Health Organization (WHO) and Bureau of Indian Standards (BIS).

UNIT- II

Chemical Properties of Water: p^H -Alkalinity, Acidity and their Measurements, Ionization Potential, Gas solubility, Precipitation and Dissolution of Ions, Equivalent Weight and its measurement, Colloids and Coagulation, Insoluble Components and their Measurements.

UNIT- III

Laboratory Methods of Analysis: Standard Solutions – Determination of p^H – Hardness – Dissolved Oxygen – BOD – COD, TDS-TSS. Determination of F, Cl, N, P, K, Na, Ca, Mg, Fe, $CaCO_3$, HCO_3^- & Trace metals.

UNIT- IV

Utility of Standards required for Potable, Agricultural and Industrial Purposes. Tools used for assessing the quality of water.

UNIT-V

Water Pollution: Urban, Industrial pollution and Remedial measures. Arsenic and Fluoride Content in water. Recycling of water, Water borne diseases, Reverse Osmosis (RO) System and Desalination of water.

REFERENCE BOOKS

1. Davis, N.S., Dewiest, R.J.M. (1996), Hydrogeology, John Wiley, New York.
2. Todd, D.K., (2002), Ground water 3rd edition, John Wiley, Singapore.
3. Freeze, R.A., Cherry, J.A. (1979), Ground Water, Prentice Hall, New Jersey.
4. Sawyer, C.N., McCarty, P.L. (1978), Chemistry for Sanitary Engineers, 3rd edition, McGraw Hill, New York.
5. APHA, (1980), Standard Methods for the Examination of Water and Waste Water, 15th edition, American Water Works Association and Water Pollution Control

B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSES PAPER VI
GEOSTATISTICS AND COMPUTER APPLICATIONS
21UGYS06

COURSE OBJECTIVE:

1. To understand the description of statistical parameters employed to analyse. 2. To synthesize geological data for accurate and authentic interpretation.

GEOSTATISTICS

UNIT- I

Geoscience Systems and Statistics: Numerical data in Geoscience. Frequency distribution: Mean Median, Mode, Dispersion and Measures of Central Tendency: Merits and Demerits. Measures of Dispersion: Skewness and Kurtosis, Addition, Multiplication and Division.

UNIT- II

Sampling and Sampling plan in Geoscience: Theoretical basis and sampling: Sample Random Sampling Systematic and Stratified and Cluster sampling: Standard Errors. Null Hypothesis. Correlation and Regression Analysis in Geoscience.

COMPUTER APPLICATIONS

UNIT- III

Introduction to Computer – Elements of Computer: Hardware and Software. Hardware: Input devices: Keyboard, Mouse – Output devices: Monitor, Printer – Memory – Primary: - RA, RAM and Secondary Memory: Hard Disk, Floppy & CD.

UNIT- IV

A short account on: Algorithm – Flowcharts, Programming languages – Operating Systems – DOS – Windows – DBMS. Computer applications in Geology: Flowcharts for simple Programmes – Geological aspects in Windows.

UNIT- V

Introduction to GIS Software in GIS, Utility of computer Software in Geological studies – Bar diagram, Pie diagram, Role diagrams, Scatter diagram, X-Y plots.

TEXT BOOKS

1. Balagurusamy, Introduction to Computers.
2. Saroj K. Pal (1985) – Statistics for Geoscientists: Techniques and applications, concept publishing Co., New Delhi.
3. C. Davis (1975), Statistics and data analysis in Geology, John Wiley & Sons.
4. Gupta, G.V. (1995), Basic Statistics, Chand.
5. Ravichandran, D. (2001), Introduction to Computers and communication, Tata McGraw Hill Publication Ltd.,

6. REFERENCE BOOKS

7. D.F. Merriam (1989), Edited Statistical Analysis: A Computer Oriented Approach, Computer Application in the Earth Sciences, A.A. Affi. An International Symposium Pienum Press, New York.
 8. Robert L. Miller (1982), Statistical analysis in the Geological Sciences, John Wiley and Sons, New York.
 9. Palk, S.K. (1998), Statistics for Geoscientist Techniques and Applications.
 10. Gregory, S. (1963), Statistical Methods and the geographer Long man & London.
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B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSE PAPER VII
REMOTE SENSING AND GIS
21UGYS07

COURSE OBJECTIVE:

To impart knowledge and applications of remote sensing and GIS in Geology. 2. To learn basic of aerial remote sensing and its applications.
To understand the physics of electromagnetic spectrum and learn satellite remote sensing.
To have training in GIS components, models and applications

REMOTE SENSING

UNIT- I

Definition and Types: Aerial, Satellite and Radar, Development of Space Programmes - History and Organization Associated with Remote Sensing in India and in other Countries.

UNIT- II

Remote Sensing: Sources of Energy, Electromagnetic Radiations (EMR) Atmospheric Windows, Energy Interaction with Atmosphere and Earth. Types of Platforms: Active and Passive. Remote Sensing Methods, Ideal Remote Sensing Systems.

UNIT- III

Fundamentals of Aerial Remote Sensing: Components of Aerial Camera, Types of Aerial Photographs, Marginal Information of Aerial Photographs, Elements of Photo Interpretation.

GIS

UNIT -IV

Fundamentals of Satellite Remote Sensing: Types of Satellites: Geo-Stationary and Sun-Synchronous Satellites, Resolution: Spatial, Spectral, Radiometric and Temporal, Types of Data Products, Marginal Information of Satellite Images.

UNIT- V

Geographical Information Systems (GIS) Meaning- Developments-Raster and Vector Data-Data Integration-Global Positioning System (GPS) Advantages and Limitations of GIS and GPS.

REFERENCE BOOKS

1. Barret, E.C. and Curtie, L.F. (1990), Introduction to Environmental Remote Sensing, Chapman and Hall, London.
 2. Cambell, James B. (1987), Introduction to Remote Sensing, The Guilford Press, New York.
 3. Lillesand, T. M. and Kieper (1987), Remote Sensing and Image Interpretation, John Wiley and Sons, New York.
 4. Lueder, D.R. (1959), Aerial Photographic Interpretation, McGraw Hill Book, ce., New York.
 5. Wolf, P.R. (1974), Elements of Photogrammetry, McGraw Hill, New York.
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B.Sc. APPLIED GEOLOGY**LIST OF SKILL BASED ELECTIVE COURSES PAPER VIII
MINES AND MINERALS LEGISLATION OF INDIA
21UGYS08****COURSE OBJECTIVES:**

1. The course aim to provide an overview of the legal and policy framework on the mining sector in India.
2. To understand the procedure for obtaining mineral concession of regulation and development.

UNIT- I

Introduction to Mineral Economics; Essential, Critical and Strategies minerals - Demand and Supply- National Mineral Policy – Problems and Prospects – Industrial policy Resolutions, 1956 – Schedule – A, Schedule – B, Energy policy, Forest policy.

UNIT-II

Essential - Strategic and Critical minerals – Minor minerals – Major minerals. Evolution of National Mineral policy – Ideal Scope of a Mineral Policy – Categories of Minerals for Grant of Concessions.

UNIT- III

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.

UNIT- IV

Mineral Concession Rules, 1960 – The Mining leases (Modification of terms) Rules, 1956 – Minerals Conservation and Development Rules, 1958. The Coal mines Act, 1974 - Coal mines Regulation, 1957.

UNIT- V

The Atomic Energy Act, 1957 – The Atomic Energy Act, 1962 – The Mines Act, 1952 – Mines Rules, 1955 — Metalliferous Mines Regulation, 1961 – Mineral Taxation and Incentive measures – Incidence of Taxes – Depletion Allowance – Simplification of Taxation laws.

REFERENCE BOOKS

1. An Introduction to Mineral Economics – K.K. Chatterjee.
 2. Mineral Economics - R.K. Sinha & N.L. Sharma.
 3. Industrial Minerals and Rocks of India (1980) – S. Deb, Allied Publishers.
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B.Sc. APPLIED GEOLOGY**LIST OF SKILL BASED ELECTIVE COURSES PAPER IX****INTRODUCTION TO GEONSTRUMENTATION****21UGYS09****COURSE OBJECTIVE:**

1. To train the students to understand functioning of necessary instruments required during geological field survey.
2. To impart knowledge and applications of field photographic techniques and GIS in Geology.
3. To train the students description handling and application of the following equipments.

UNIT- I

Basic Equipments: Description, Handling and Applications of the following equipments: Hammers, Chisels, Hand lenses, Clinometer, Brunton Compass, Jacob's staff, Pedometer.

UNIT- II

Survey Equipments: Chain survey, Plane Table, Prismatic Compass, Theodolite, GPS. Field Photographic Techniques, Spot Analysis Kit for water and Soil test.

UNIT- III

Geophysical Survey Equipment: Gravimeters, Magnetometers, Resistivity Survey Equipments, Seismic Survey Equipments, Scintillation counter, Well logging Instruments.

UNIT- IV

Pocket Stereoscope, Mirror Stereoscope, Stereometer, Pantograph, Rotometer, Plotting Equipments. Petrological Microscope, Ore Microscope, Photomicrograph Equipment, Stereomicroscope.

UNIT-V

Geochemical Equipment: p^H & Eh meters, Potentiometers, TDS determination, Chromatographic Techniques, AA Spectrometer, ICP – MS, XRF – XRD.

REFERENCE BOOKS

1. Field Geology - S.M. Mathur
 2. Field Geology -Gokhale
 3. Field Geology - F. Lahee 4
 4. Field Geology - R. Compton
 5. Surveying -Punmia
 6. Geophysics -Telford
 7. Geophysics – Ramachandra Rao
 8. Mineralogy -Dennan
 9. Text Book of Surveying - S.K. Husain and M.S. Nagaraj.
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B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSES PAPER X
CARTOGRAPHY
21UGYS10

COURSE OBJECTIVE:

1. To understand the various purposes, roles and representation of cartography. To gain and practice language in the creative design process.
2. To gain and practice skills in cartographic design, representation and produced in a GIS environment.
3. To be able to create digital maps in formats reflecting the purpose, content and function of input data.

UNIT- I

Cartography - Nature, Scope and Content of Cartography - Arts and Science of Cartography - Cartography as a system of communication - Maps - Classification and their uses - Growth, Development and Modern trends in cartography.

UNIT- II

Map Drawing and Measuring Techniques - Map Setting – The Earth and System of Coordinates - Base Map - Compilation and Generalization of Maps.

UNIT- III

Symbolization: Types of Cartographic Symbols - Point, Line, and Area symbols - Qualitative and Quantitative Data Generalization.

UNIT- IV

Map Design and Layout: General Design Problems - Principles of Cartographic design and Design of Map Symbols - Lettering – Lettering Methods, Positioning of letters - Geographical names.

UNIT- V

Map Reproduction - Process of Map Production –Photographic Systems - Multiple

Reproduction Processes - Computer Application in Cartography - Computer Mapping - Remote Sensing and Cartography - Uses of Air photographs and Satellite images in Cartography.

REFERENCE BOOKS

1. Misra, R.P. and A.P. Ramesh - Fundamentals of Cartography
 2. Robinson - Elements of Cartography
 3. Keats, J.S - Cartographic Design and Production.
 4. Raiz - Principles of Cartography.
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B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSES PAPER XI
GEOLOGY FOR COMPETITIVE EXAMINATIONS
21UGYS11

COURSE OBJECTIVE:

1. To impart knowledge of objective geology for various competitive examination, know about various question paper pattern information.

UNIT-I

Types of Competitive examinations: State and Central Competitive examinations – TNPSC, UPSC (Civil Services, GSI, IFS), UGC-CSIR, ONGC, AMD, Coal India Ltd etc.

UNIT-II

Awareness of syllabus prescribed for various competitive examinations. Objective and descriptive type of questions. Preparation strategies - Collection of previous question papers - Internet and library search for information.

UNIT- III

Scope and limits of Objective type examinations - Pattern and Style of Objective type Questions - Level of difficulty and Standard Expected - Long Term study and Planning. Preparation strategies for short answer and short essay type examination.

UNIT- IV

Study methods - Objective type - Short essay type. Examination techniques: - Pre- Exam preparation - Writing / Choosing Questions from Simple to Complex (or) very known to partly known before Answering/ writing Answers – Time Concept and Examination Ethics.

UNIT- V

Interview - Basic English, Mathematical Ability, Logical Reasoning and Mental Aptitude - Group Discussion, Technical Interview and Management Round. Dress Code and Physical Fitness.

REFERENCES BOOKS

1. Julka and Ravi Misra (2003), Geo informa – for the cause of promoting Geoscience, Technology Publications, Dehradun.
 2. Maddox, H. (1985), How to study, Rupa publications, Delhi
 3. Barrass, R.C. 2001, Study, Routledge study guides, Chapman & Hall, 4. Srivastava
 4. A.P. (1994), Scoring high in examinations, hearting laboratory publications, Delhi.
 5. Barles Rob, (1992), Successful study for degrees, Routledge, London.
 6. Sayeed, A. (2002), Trends in objective Geology, CBS, Delhi
 7. Jhulka, A. (1992), Objective Geology, CBCS, Delhi,
 8. Bopche, A. (1999), Objective Geology, Dhanpat Rai, Delhi.
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B.Sc. APPLIED GEOLOGY
LIST OF SKILL BASED ELECTIVE COURSES PAPER XII
PRINCIPLES OF SURVEYING
21UGYS12

COURSE OBJECTIVES:

1. The systematic investigation of geology the purpose of creating a geological map. And contour and cross section.
2. To know about survey types and methods for field and ground.
3. To train the students to understanding the survey equipments.

UNIT- I

Surveying - Definition - Scope and Content - Types of Surveying - Area measurement - Height determination - Advantages of Survey.

UNIT-II

Chain Survey - Accessibility - FMB - Methods of Chain Survey - Triangulation - Open and Closed traverse - Plotting of chain Survey and Results.

UNIT- III

Prismatic Compass - Parts of Prismatic Compass - Accessories - Traverse - Plotting of Prismatic Compass - Errors and its Corrections – Bowditch's method of correction - Calculation of bearings from included Angles.

UNIT- IV

Plane Table - Equipments - Methods of Plane Table Survey - Preparation work for the Plane Table Survey - Leveling and Orienting the Table - Resection Points - Trial and Error Method - Tracing Paper Method - Advantages and Disadvantages of Plane Table Survey.

UNIT- V

Height measurement - Determination of Height - By Dumpy level- Parts of Dumpy level- Methods of dumpy level survey - Height measurement by Indian Clinometer and Abney level.

REFERENCE BOOKS

1. Lekh Raj & Raghunandan Singh - Map work and practical geography.
 2. Jayachandran – Practical Geography.
 3. ZamirAlvi - A Text book of Practical Geography.
 4. PijushkantiSaha and ParthaBasu - Advanced Practical Geography.
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B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSESPAPER-I
OCEANOGRAPHY
21UGYN01

COURSE OBJECTIVE:

1. To impart basic knowledge of morphological and structural features, and operating processes in sea and ocean basins.
2. To train the students to in understanding the marine economic resources.

UNIT-I

Oceanography: Scope, Content, Significance, Distribution of Land and Sea - Hypsometric Curve, Surface Configuration of the Ocean Floor: Continental Shelf, Continental Slope, Deep Sea Plain, Oceanic Deeps and Submarine Canyons.

UNIT- II

Relief Features of the Major Oceans: Atlantic, Pacific and Indian Ocean – Horizontal and Vertical Distribution of Seawater Temperature. Salinity: Factors Affecting Salinity and Distribution.

UNIT- III

Ocean Water Circulation: Factors Influencing Ocean Circulation - General Circulation of Ocean Currents, Currents of the Atlantic, Pacific and Indian Ocean, Waves and Tides: Definition and Types, Tsunamis: Origin and Effects.

UNIT- IV

Marine Deposits: Classification and Distribution - Coral Reefs types -Conditions for the Growth.

UNIT- V

Marine Resources: Types - Distribution and Uses - Tidal Energy - Role of National Institute of Oceanography in India.

REFERENCE BOOKS

1. Anikouchine, W. A. and Sternberg, R.W. (1973), The World Oceans - An Introduction to Oceanography, Englewood Cliffs.
2. Garrison, T. (1998), Oceanography, Wadsworth Co, USA.
3. Gerald, S. (1980), General Oceanography: An Introduction, John Wiley & Sons, New York.

4. King, C. A. M. (1972), *Beaches and Coasts*, E. Arnold, London: King, C. A. M. (1975), *Oceanography for Geographers*, E. Arnold, London.
 5. Ramasamy, G. (1970), *Oceanography (Tamil Edition)*, Tamil Nadu Text Book Society, Chennai.
 6. Sharma, R. C. and Vatel, M. (1970), *Oceanography for Geographers*, Cheytanya Publishing House, Allahabad.
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B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSESPAPER II
CLIMATOLOGY
21UGYN02

COURSE OBJECTIVES:

1. To understand the meteorology and earth radiation balance.
2. To know the behaviour of meteorological parameters.
3. To learn the concept of EL Nino impact and weather forecasting. 4. To study the climate changes over geological period and its impact.

UNIT-I

Definition and Significances of Climatology - Rotation and Revolution of the Earth, Solstice, Equinox and Seasons, Elements of Weather and Climate, Composition and Structure of the Atmosphere, Isolation: factors affecting Isolation, Global energy budget, Horizontal and Vertical Distribution Inversion of Temperature and factors affecting them.

UNIT- II

Atmospheric Pressure: Diurnal and Seasonal Variations – Vertical and Horizontal distribution and factors affecting - Pressure Gradient - Coriolis force and Deflection. Winds: Causes and Types - Jet stream, planetary winds, Monsoon and Local winds

UNIT- III

Atmospheric moisture and Precipitation: Humidity types - Condensation - Cloud types - Precipitation and Rainfall: Types and measurements.

UNIT- IV

Air Masses and Fronts: types, Classification and Properties - Atmospheric Disturbances: Tropical, Temperate Cyclones, Thunderstorms and Tornadoes - Origin, Development and associated weather conditions.

UNIT- V

Climatic Classification: Need and Basis of Climatic Classification- Koppen's Climatic Classification - Weather forecasting: Observation, Types and Uses.

REFERENCE BOOKS

Critchfield, H. (1975), *General Climatology*, Prentice-Hall, New York.
Das, R. K. (1968), *The Monsoons*, National Book Trust, New Delhi.
Mather, J. R. (1974), *Climatology*, McGraw Hill, New York.

Patterson, S. (1969), Introduction of Meteorology, McGraw Hill Book Co., London.
Stringer, E. T. (1982), Foundation of Climatology, Surjeet Publications, New Delhi.
Trewartha, G. T. (198), An Introduction to Climate, International Students Edition, McGraw Hill, New York.
Kumaraswamy, K., et al. (2003), Climatology (Tamil Edition), Grace Publishers, Kumbakonam.

**B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSES PAPER-III
BASIC GEOCHEMISTRY
21UGYN03**

COURSE OBJECTIVE:

1. To impart basic knowledge of elemental and isotopic concentrations, classification and behaviour of elements in the crust, continental lithospheric mantle and mantle.
2. To train the students to understand the behaviour of geochemical elements in different igneous rock types.

UNIT-I

Origin, Abundance and Distribution of elements in the Universe Solar System and Earth – composition of Crust, Mantle, Core, Hydrosphere and Atmosphere: Geochemical classification of Elements.

UNIT- II

Basic Crystal Chemistry: Minerals as chemical compounds-bonding – Ionization Potential-Electro negativity-Periodic Table of elements: Periodic law and its utility.

UNIT-III

Geochemical processes and their geochemical signatures - Processes controlling chemical composition of Igneous, Metamorphic, and Sedimentary rocks.

UNIT- IV

Geochemistry of REE, Trace elements, stable and radiogenic isotope and their applications.

UNIT- V

Geochemistry to mineral exploration: Elements, dispersion and halos around an ore body-sampling methodology-analytical techniques: AAS-ICP-MS- Gravimeter – Chromatography flame photometry-DTA.

REFERENCE BOOKS

1. Krouskoph, K.C. and D.K. Bird (1995) Introduction to Geochemistry, 3rd Ed Wiley, New York.
2. Mason, B. and C.B Moore, (1992), Principles of Geochemistry, 4th Ed Wiley, New York.
3. Rollinson, H. (1993), Using Geochemical Data evaluation, preparation and interpretation, Longman, Singapore.

B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSES PAPER IV
BASIC GEOPHYSICS
21UGYN04

COURSE OBJECTIVE:

1. To impart knowledge of Geophysics and applications of physics in geology
2. To enhance knowledge and applications of geophysics in exploration of earth resources.

UNIT-I

Definition and scope of Geophysics. Resistivity, Electrical conduction through rocks, Range of Resistivity for Rock Sand Minerals. Measurement of Earth Resistivity: Measurement of Earth Resistance, Potential Distribution, Electrode Configuration, Configuration factor, Wenner Array, Lee Partitioning Array, Schlumberger Array, Dipole Arrays, Gradient Array.

UNIT- II

Seismic properties of rocks, Densities of various layers of earth (Lithosphere). Distribution of density and pressure within Earth. Survey Procedure: Electrical Profiling, Resistivity Sounding (VES), Precautions.

UNIT- III

Heat flow: Definition – Units – Origin – Causes. Geotherms: Continental and Oceanic. Heat flow measurements. Earth's magnetism: Definition – Parts of earth's magnetic field – Variation of Earth's field – Magnetic properties of rocks and minerals – Basic outline of Palaeomagnetism.

UNIT- IV

Geochronology: Definition – Methods – Limitations – Radioactivity schemes – Concordia and Discordia ages.

UNIT -V

Isostasy: Definition – Scope – Different Theories and limitations of Isostasy. Introduction to Geophysical tools.

REFERENCE BOOKS

Lowrie, W.F. (2008) Fundamentals of Geophysics, 2nd edition, Cambridge University Press, Cambridge U.K.
Anderson, D.L. (2007) Theory of Earth, 2nd edition, Cambridge University Press, Cambridge U.K., Holmes A.L. (revised by Duff & Others), (1995) Physical Geology, 5th edition ELBS, London.

B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSE PAPER V
GEOHAZARDS
21UGYN05

COURSE OBJECTIVES:

1. To explain students about the physical and geological processes causing geohazards. To discuss the methods for quantifying geohazards.
2. To understand the possible consequences as well as risk and disaster management.
3. To make them aware about landslides, floods, tsunamis and earthquakes, for which the geological and physical process were to be discussed.
4. To discuss potential inter linkages between different types of geohazards, disaster prevention and management and quantification and communication of uncertainties.

UNIT-I

Geological Hazards: Introduction to Natural Hazards. Earthquakes: Causes and Measurements – Earthquake Hazards and Risks – Earthquake Prediction and Control – Earthquake Case Histories – Tsunami.

UNIT- II

Volcanoes, Magma, and Volcanic Eruptions- Volcanic Landforms, Volcanoes and Plate Tectonics – Volcanic Hazards, Beneficial Aspects, and Predicting Eruptions- Volcanic Case Histories.

UNIT- III

Landslides – Mass Wasting and Mass – Wasting Processes – Slope Stability, Triggering Events, Mass Wasting Hazards – Subsidence: Dissolution & Human Related Causes.

UNIT- IV

The Ocean-Atmosphere System – Thunderstorms & Tornadoes – Tropical Cyclones – Hurricane – Tornadoes – Windstorms – Lightning – Drought – Frost and Freezes – Wild Fire.

UNIT- V

Coastal Zones – Coastal Erosion – River Systems & Causes of Flooding – River Flooding – Flooding Hazards, Prediction and Human Intervention. Extra-terrestrial Hazards. Meteorites & Impacting Events.

REFERENCE BOOKS

1. Montgomery, C.W. (2008), Environmental Geology, McGraw Hill 8th Edition.
 2. Abbott Patrick, L. (2006), Natural Disasters, McGraw Hill, Boston, MA.
 3. Bryant, E. (2005), Natural Hazards, Cambridge University Press, Cambridge, U.K.
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B.Sc. APPLIED GEOLOGY
LIST OF NON-MAJOR ELECTIVE COURSES PAPER V
GROUNDWATER MANAGEMENT AND RAINWATER HARVESTING
21UGYN06

COURSE OBJECTIVE:

1. To impart knowledge of global and national scenario of water resources and associated challenges.
2. To familiarize about occurrence and movement of sub-surface water. Also to train students about various groundwater management techniques.
3. To understand the importance of rainwater harvesting for water supply and will learn about different types of rainwater harvesting systems.
4. To get familiar with different potential uses of rainwater and understand the advantages and limitations.
- 5.

UNIT- I

Groundwater development – Dynamic Equilibrium in Natural Aquifers –Groundwater budget – management Potential of Aquifers – Safe yield – Water law –Legal concepts.

UNIT- II

Parameters of groundwater balance – Conjunctive and Consumptive use. Modeling Techniques in groundwater management. Groundwater resources evaluation in India. Estimation of recharge components.

UNIT- III

Sampling of Geological material: Types of geological samples – Precaution – Collection and marking of samples and their location – Storage of samples – Outline of Methodology - followed in Mineral, Core, Rocks and Fossil sampling. Report writing: (purpose and scope) – Style – Clarity – Drawings and Diagram – Section.

UNIT- IV

Groundwater Mining and Cyclic storage. Rainwater, Surface water and groundwater interactions. Problems and remedial methods. Watershed management.

UNIT-V

Rain water harvesting: Definition and types – storm water harvesting – rooftop harvesting – ground water recharge - storage tanks – check dams - quality developments. Consumptive and Conjunctive use of water.

REFERENCE BOOKS

1. Todd, D.K., (2002), Ground Water, 3rd edition, John Wiley, Singapore.
2. Fetter, C.W. (1990), Applied Hydrogeology, 2nd edition, CBS, New Delhi.
3. Karanth, K.R. (1980), Ground Water Assessment Development and Management, Tata McGraw Hill, New Delhi.

4. Chaturvedi, M.C. (1987), Water Resources Systems Planning and Management, Tata McGraw Hill, New Delhi.
 5. Davis, N.S., De Wiest, R.J.M. (1979), Hydrogeology, John Wiley, New York.
 6. Freeze, R.A., Cherry, J.A. (1979), Ground Water, Prentice Hall, New Jersey.
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B.Sc. APPLIED GEOLOGY 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 to the local area for studying Geomorphological, Structural aspects 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 geological 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 Tamil Nadu it includes mine visit, geological mapping, minerals, rocks collection and display at the time of their practical examination for internal evaluation. The duration may be for two weeks.

B.Sc. GEOGRAPHY ALLIED GEOLOGY PAPERS

Allied Geology paper – 1 (21UGYA01)	Third Semester
Allied Geology paper – 2 (21UGYA02)	Fourth Semester
Allied Geology Practical (21UGYAP01)	Fourth Semester

ALLIED GEOLOGY–I (21UGYA01)

UNIT - I

General Geology: Definition and scope of Geology. Origin of solar system: Nebular and Planetesimal hypotheses. Introduction and outline of constitution and composition of earth's interior. Brief account of the important methods of determining the age of the earth. Earthquakes and their effects. Short note on seismograph and seismogram. Richter's scale of earthquake intensity. Brief account of volcanoes.

UNIT-II

Structural Geology: Definition and scope of Structural Geology. Concept of rock Outcrop -Definition of Dip and Strike of Rock formations. Folds: definition and parts of a fold. Brief description of the following fold types: Anticline, Syncline, Symmetrical, Asymmetrical, Isoclinal and Recumbent folds. Brief description of the following fold systems: Anticlinorium and Synclinorium. Faults: definition and parts of a fault. Brief description of the following types faults: Normal, Reverse, Strike, Dip, Oblique, Parallel and Step Faults, Brief outline of Joints and Unconformities.

UNIT- III

Crystallography: Definition of crystallography and crystals. Morphological characters of crystals: Faces – Forms – Edges. Symmetry elements of crystals: Axis, Plane and Centre of symmetry. Miller's Indices. Study of the following Crystal Systems: Normal Classes of the Cubic, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic systems.

UNIT- IV

Mineralogy I: Definition of Mineralogy and Mineral. Outline of physical properties of minerals: Color, form, luster, Hardness, Cleavage, fracture and Specific gravity. Description of the following minerals: Quartz. Orthoclase – Microcline – Albite – Labradorite - Anorthite. Nepheline – Leucite-Sodalite. Enstatite - Hypersthene – Augite – Diopside.

UNIT-V

Mineralogy II: Description of the following minerals: Hornblende – Actinolite Tremolite. Muscovite – Biotite – Chlorite. Topaz-Olivine - Serpentine – Talc. Tourmaline – Beryl – Apatite – Corundum. Garnet-Diamond. Garnet – Beryl – Topaz – Apatite – Staurolite – Sillimanite – Epidote – Tourmaline – Corundum – Diamond.

REFERENCE AND TEXTBOOKS

1. Parbin Singh, B. (2005), A Textbook of Engineering and General Geology S.K.Kataria & Sons, Delhi.
 2. Mukherjee, P.K. (1984), A Textbook of Geology, World Press, Kolkata.
 3. Mahapatra, G.B. (1994), Textbook of Physical Geology, CBS Publishers, Delhi.
 4. Mahapatra, G.B. (2000), General Geology, CBS Publishers, Delhi.
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**B. Sc. GEOGRAPHY
ALLIED GEOLOGY PAPERS
ALLIED GEOLOGY–II
(21UGYA02)**

UNIT-I

Palaeontology: Definition of Palaeontology and fossils. Outlines of modes of preservation in sedimentary rocks. Brief account of the uses of fossils. Study of the morphological characters and geological age of the following fossil groups: Pelecypods, Gastropods, Cephalopods, Brachiopods, Corals, and Trilobites.

UNIT-II

Stratigraphy: Definition and scope of Stratigraphy. Outline of the Geological Time Scale. Brief account of the following geological formations in India: Dharwar Group, Cuddapah Group, Vindhyan Group, Gondwana Group, Cretaceous formations of Tiruchirappalli and Karewa Formation.

UNIT- III

Igneous Petrology: Definition of Igneous Petrology and Igneous rocks. Forms of Igneous rocks: Sill, Lopolith, laccolith, Phacolith, Dyke, and Batholith. Brief description of the following igneous rocks: Dunite, Pyroxenite, Gabbro, Dolerite, Syenite, Granite, Pegmatite, Aplite, Andesite, and Basalt.

UNIT- IV

Sedimentary Petrology: Definition of sedimentary rocks and sedimentary petrology. Primary structures of sedimentary rocks: Common bedding, cross-bedding, current-bedding, graded-bedding. Surface structures: Ripple marks, Mud-cracks, and Rain prints. Brief description of the following sedimentary rocks: Sandstone, Arkose, Grit, Shale, and Limestone.

Metamorphic Petrology: Definition of metamorphic rocks. Metamorphism and metamorphic process. Agents of metamorphism. Brief description of the following sedimentary rocks: Sandstone, Arkose, Grit, Shale, and Limestone. Brief description of the following metamorphic rocks: Slate, Phyllite, Schist, Gneiss, Marble, Quartzite, Granulite, and Amphibolite.

UNIT- V

Economic Geology: An outline of the following processes of ore formation: Magmatic – Hydrothermal – Placer – Marine Evaporites. Brief description of the physical properties and Indian occurrences of the following ore and industrial minerals: Graphite, Bauxite, Magnesite, Hematite, Magnetite, Chromite, Gold, pyrolusite, pyrite, Galena, Asbestos, Gypsum, Chalk, Calcite, Dolomite, Barite, and Kaolin. Brief description of the following coal types: Peat, Lignite, Bituminous, and Anthracite. Brief introduction to petroleum, its origin and occurrence in India.

REFERENCE AND TEXTBOOKS

1. Parbin Singh, B. (2005), A Textbook of Engineering and General Geology, S.K. Kataria & Sons, Delhi.
 2. Mukherjee, P.K. (1984), A Textbook of Geology, World Press, Kolkata.
 3. Mahapatra, G.B. (1994), Textbook of Physical Geology, CBS Publishers, Delhi.
 4. Mahapatra, G.B. (2000), General Geology CBS Publishers, Delhi.
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**B. SC. GEOGRAPHY ALLIED GEOLOGY PAPERS
ALLIED GEOLOGY PRACTICAL**

Crystallography: Simple forms of the Normal classes of the different crystal systems and models representing the following minerals: Cubic system: Galena, Fluorite, and Garnet. Tetragonal system: Zircon, Cassiterite. Hexagonal system: Beryl. Orthorhombic system: Barite, Sulfur, Staurolite. Monoclinic system: Gypsum. Triclinic system: Axinite.

Mineralogy: Identification and physical description of the following minerals: Quartz Group: Rock crystal, Chalcedony, Agate, Jasper, Flint. Feldspar Group: Orthoclase, Microcline, Albite, Perthite. Pyroxene Group: Augite, Hypersthene. Amphibole Group: Hornblende, Tremolite, Actinolite. Mica Group: Muscovite, Biotite, Chlorite. Other silicate minerals: Olivine, Garnet, Beryl, Tourmaline, Staurolite. Non silicates: Corundum, Apatite. Ore minerals: Magnetite, Chromite, Bauxite, Pyrolusite, Pyrite, Galena, Hematite. Industrial Minerals: Talc, Asbestos, Magnesite, Barite, Gypsum. Coal varieties: Peat, Lignite, Bituminous, and Anthracite.

Petrology: Identification and physical description of the following rocks: Igneous rocks: Granite, Pegmatite, Syenite, Diorite, Gabbro, Dolerite, Dunite, Pyroxenite. Metamorphic rocks: Slate, Mica schist, Chlorite schist, Hornblende gneiss, Garnet-mica gneiss, Granulite, Marble. Sedimentary rocks: Sandstone, Conglomerate, Arkose, Grit, Shale, Limestone.

Fossils: Identification and Morphological description of the following fossils: Pelecypods: Meretrix, Arca, Pecten, Ostrea. Gastropods: Turritella, Natica, Turbo, Conus. Cephalopods: Nautilus, Acanthoceras. Brachiopods: Terebratula, Spirifer. Trilobites: Calymene, Paradoxides. Corals: Calceola, Lithostrotion. Plant Fossils: Glossopteris, Ptilophyllum.

Geological Maps: Geological map drawing exercises: drawing strike lines and determining dip amounts. Outcrop completion geological maps with conformable series of beds. Preparation of geological ph sections for conformable series of beds.
