PERIYAR UNIVERSITY

PERIYAR PALKALAINAGAR

SALEM – 636011

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 2017 - 2018 onwards)

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REGULATIONS

1. ELIGIBILITY

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

2. 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.

3. 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.

I. SEMESTER

1. Language -I (Tamil etc)
2. English -I
3. Core -I Physical Geology and Geodynamics
4. Allied Chemistry Paper -I (or) Allied Maths -I
5. Skill Based Elective Courses-I
6. Value education

II. SEMESTER

7. Language -II (Tamil etc)
8. English -II
9. Core -II Geomorphology and Structural Geology
10. Core Practical -I* Structural Geology and Surveying

11. Allied Chemistry -II (or) Allied Maths -II
12. Allied Chemistry Practical -I* or Allied Maths-III
13. Skill based Elective Course -II
14. Environmental Studies

III. SEMESTER

15. Language -III (Tamil etc)
16. English -III
17. Core Geology -III Palaeontology
18. Allied Physics -I
19. Skill based Elective Course -III
20. Non -Major Elective Course -I

IV. SEMESTER

21. Language -IV (Tamil etc)
22. English -IV2
23. Core Geology-IV Stratigraphy
24. Core Geology Practical Paper-II Palaeontology and Stratigraphy
25. Allied Physics -II
26. Allied Physics Practical - I*
27. Skill based Elective Course -IV
28. Non -Major Elective Course -II

V. SEMESTER

29. Core Geology - V Crystallography
30. Core Geology -VI Mineralogy
31. Core Geology -VII Igneous Petrology
32. Core Geology -VIII Sedimentary and Metamorphic Petrology
33. Skill based Elective Course -V
34. Skill based Elective Course -VI
35. Non -Major Elective Course -III

VI. SEMESTER

36. Core Geology -IX Economic Geology
37. Core Geology -X Photogeology and Remote Sensing
38. Core Geology -XI Mining and Engineering Geology
39. Core Geology -XII Hydrogeology and Environmental Geology
40. Core Geology Practical -III* Crystallography and Mineralogy
41. Core Geology Practical -IV* Economic Geology and Petrology
42. Skill based Elective Course -VII

List of Skill Based Elective Courses

I. Principles of Surveying
II. Remote Sensing and GIS
III. Cartography
IV. Field Hydrogeology and Techniques
V. Geostatistics and Computer Applications
VI. Gemology and Gemstone Evaluation VII.
Granite exploration and exploitation VIII.
Mines and Minerals Legislation of India IX.
Introduction to Geoinstrumentation
X. Water Quality Analysis
XI. Mapping Techniques in Geology
XII. Geology for competitive examination.

List of Non-Major Elective Courses

I. Oceanography
II. Climatology
III. Basic Geochemistry
IV. Basic Geophysics V.
Geohazards
VI. Groundwater Management and Rain Water Harvesting

List of Compulsory Courses

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

4. 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

5. Scheme of Examinations

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

COURSE OF STUDY AND SCHEME OF EXAMINATION

SEMESTER - I

	Title of the course	Instructional hoursperweek	Examhours	Credits	Marks		
					Internal Marks	Semester Examination	Total
I	Tamil or any other Language paper -I	6	3	3	25	75	100
II	English - I	6	3	3	25	75	100
III	Core I - Geology - I	5	3	4	25	75	100
III	Core Practical I Geology Practical -I*	3	3	-	-	-	-
III	Allied - I Chemistry Paper -I or Maths -I	5	3	4	25	75	100
III	Allied Practical I Chemistry Practical -I*	2	3	-	-	-	-
IV	Skill based Elective course-I (Select any one from the list)	2	3	2	25	75	100
IV	Value education	2	3	2	25	75	100

* - Examinations will be at the end of II semester

SEMESTER - II

	Title of the course	Instructional hoursperweek	Examhours	Credits	Marks		
					Internal Marks	Semester Examination	Total
I	Tamil or any other Language - II	6	3	3	25	75	100
II	English - II	6	3	3	25	75	100
III	Core II - Geology	5	3	4	25	75	100
III	Core Practical I - Geology *	3	3	5	25	75	100
III	Allied II - Chemistry -II or Maths -II	5	3	4	25	75	100
III	Allied Practical I Chemistry -I* or Allied Maths -III	2	3	4	25	75	100
IV	Skill based Elective course- II (Select any one from the list)	2	3	2	25	75	100
IV	Environmental studies*	1	3	2	25	75	100

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

Total Credit for I and II Semester = 45 credits

Total Marks for I and II Semester = 1400 Marks

SEMESTER - III

Part	Title of the course	Instructional hoursperweek	Examhours	Credits	Marks		
					Internal Marks	Semester Examination	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 III - Geology	5	3	4	25	75	100
III	Core Practical II - Geology*	3	3	-	-	-	-
III	Allied Physics -I	5	3	4	25	75	100
III	Allied Practical I - Physics - I*	2	3	-	-	-	-
IV	Skill based Elective course- III (Select any one from the list)	2	3	2	25	75	100
IV	Non-Major elective course -I	2	3	2	25	75	100

* - Examinations will be at the end of IV semester

SEMESTER - IV

Part	Title of the course	Instructional hoursperweek	Examhours	Credits	Marks		
					InternalMarks	SemesterExamination	Total
I	Tamil or any other Language - IV	6	3	3	25	75	100
II	English - IV	6	3	3	25	75	100
III	Core IV - Geology	5	3	4	25	75	100
III	Core Practical II - Geology *	3	3	5	25	75	100
III	Allied II - Physics II	5	3	4	25	75	100
III	Allied Practical I - Physics - I*	2	3	4	25	75	100
IV	Skill based Elective Course -IV (Select any one from the list)	2	3	2	25	75	100
IV	Non Major elective course -II (Select any one from the list)	2	3	2	25	75	100

* - 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

SEMESTER - V

	Part Title of the course	Instructional hours per week	Exam hours	Credits	Marks		
					InternalMarks	SemesterExamination	Total
I	Core V - Geology	5	3	4	25	75	100
I	Core VI - Geology	5	3	4	25	75	100
I	Core VII - Geology	5	3	4	25	75	100
I	Core VIII - Geology	5	3	4	25	75	100
II	Core Practical III - Geology *	3	3	-	-	-	-
III	Core Practical IV - Geology *	3	3	-	-	-	-
IV	Skill based Elective course-V (Select any one from the list)	2	3	2	25	75	100

* - Examinations will be at the end of VI semester

SEMESTER - VI

	Title of the course	Instructional hours per week	Exam hours	Credits	Marks		
					Internal Marks	Semester Examination	Total
I	Core Geology -IX	5	3	4	25	75	100
III	Core Geology -X	5	3	4	25	75	100
III	Core Geology -XI	5	3	4	25	75	100
III	Core Geology -XII	5	3	4	25	75	100
III	Core Geology Practical -III*	3	3	5	25	75	100
III	Core Geology Practical -IV*	3	3	5	25	75	100
IV	Skill based Elective course- VII (Select any one from the list)	2	3	2	25	75	100

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

Total credit for V and VI semester = 50

Credits Total Marks for V and VI Semester = 1400

Marks Total credit for 3 years = 140 Credits

Total Marks for 3 years = 4200 Marks

6. Question Paper pattern for Examination

Time : 3 Hrs. Max. Marks - 75

Part A: 10 x 2=20 Marks

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

Part B: 5 x 5 =25 Marks

(Answer all Questions)

(One question from each unit with internal choice)

Part C: 3 x 10 = 30 Marks

(Answer any three Questions out of five) (One question from each unit)

7. Passing Minimum

Theory : IA : 25 marks □□□□□□□□□□□□□□□□□□□□□□□□□□□ **University Examination : 75 marks**

Evaluation of IA		Passing minimum	
Tests	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:

IA : 25 Marks □ □ □ **University Examination : 75 marks**

Evaluation of IA		Passing minimum	
Field visit, Collections Report	10 marks	IA (40%)	10 marks
Model Exam	05marks	UE (40%)	30 marks
Record Submission	05 marks	Total	40 marks
Attendance	05 marks		
Total	25 marks		
UE	75 marks		

8. 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	70-89
C	7	Good	60-69
D	6	Average	50-59
E	5	Satisfactory	40-49
RA	0	Re-Appear	0-39

$$GP = \frac{(\text{Marks obtained in course} \times \text{credit})}{100}$$

$$GPA = \frac{\text{Total Grade Points earned in a semester}}{\text{Total credits registered in a Semester}}$$

$$GPA = \frac{\text{Sum of Grade Points earned}}{\text{Sum of credits registered}}$$

Classification

CGPA**9 and above**I Class with DistinctionCGPA**between 7 and 8.9**I ClassCGPA**between 5 and 6.9**II Class**Note:**

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

9. Maximum duration for the completion of UG Program

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

10. Commencement of this Regulation

These regulations shall take effect from the academic year 2017 - 2018 and thereafter.

11. 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 2020. Thereafter they will be permitted to appear only under regulations then in force.

B.Sc. APPLIED GEOLOGY

SEMESTER - I

CORE I - PHYSICAL GEOLOGY AND GEODYNAMICS

Unit – I

Geology: Scope and importance, branches of Geology. Solar System: Planets, Satellites, Asteroids, Meteorites and Comets. Origin of Solar system: Nebular, Planetesimal, and Tidal hypotheses – Earth in the Solar system: Size, Shape, Mass, Density, Rotational and Revolution parameters. Brief description of 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, 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.

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. oceanic trenches, volcanic arcs, mid-ocean ridges, Palaeomagnetism and its application, Raised beach, River terraces, river meandering.

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. Radhakrishnan. V 1996 General Geology. V.V.P. Publishers, Tuticorin.
5. Parbin Singh2000 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

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

B.Sc. APPLIED GEOLOGY

SEMESTER-II

CORE II - GEOMORPHOLOGY AND STRUCTURAL GEOLOGY

Unit I

Meaning - scope - content and significance of Geomorphology, Geomorphic Processes: Internal and external processes - Diastrophism and Denudation, Internal Process - Faults, Folds and Cracks, Volcanism and Earthquakes: types and distribution.

Unit II

External processes: Weathering: Physical, Chemical and Biological. Mass wasting: Soil creep, landslide, rock fall, rock slip and mud flow. Landforms produced due to erosion and deposition with reference to: River and Underground water. Drainage pattern, network characteristics, Valleys and their development,

Unit III

Landforms produced due to erosion and deposition with reference to: Glaciers, Winds, and Waves. Uplift – subsidence pattern in coastal areas, Applied Geomorphology: Application in various fields of earth sciences Mineral prospecting, Geohydrology, Civil Engineering and Environmental studies, Geomorphology of India

Unit IV

Principle of geological mapping and map reading, projection diagrams. Stress-strain relationships for elastic, plastic and viscous materials. Measurement of strain in deformed rocks. Behaviour of minerals and rocks under deformation conditions. Structural analysis of folds, cleavages, lineations, joints and faults. Superposed deformation. Mechanism of folding, faulting and progressive deformation.

Unit V

Shear Zones: Brittle and ductile shear zones, geometry and products of shear zones; Mylonites and cataclasites, their origin and significance.Time relationship between crystallization and deformation. Unconformities and basement-cover relations.Structural behaviour of igneous plutons, diapirs and salt domes. Introduction to petrofabric analysis.

Geomorphology

TEXT / REFERENCES BOOKS

1. Richard Huggett. (2007) Fundamentals of Geomorphology. II Edition. Routledge N. Y.

2. Ritter,D.F., Kochel, R.C.,Miller, J.R., (2002) Process Geomorphology, Waveland press.

3. H.S. Sharma (1990). Indian Geomorphology. Concept Pub. Co., New Delhi.

4. Robert, S.A. and Suzanne, P.A., (2010) Geomorphology – The mechanics and chemistry of landscapes. Cambridge University Press.

5. Thornbury, W.D., (2004) Principles of Geomorphology. II edition. Wiley Eastern Ltd. New Delh

Structural Geology

TEXT BOOKS:

1. Billings, M. P.Structural Geology: Prentice Hall, Englewood Clifts, U.S.A.

2. Novin, C. M. Principles of structural Geology John Willey, New York.

3. Gokhale, N. W. : Theory of Structural Geology. CBS Publishers.

REFEREANCE BOOKS

1. V.V. Belousov-Structural Geology, Moscow

2. P.C. Bedgley-Structural and Tectonic, Principles : Harper & Row, New york.

3. E.W. Spencer-An Introduction to structural Geology : Mc GrawHill, New York.

4. Park, P.G.-Fundamentals of structural Geology, John Willey & Sons,

B.Sc. APPLIED GEOLOGY

SEMESTER-II

CORE PRACTICAL I - STRUCTURAL GEOLOGY AND SURVEYING

Structural Geology :

Contour maps and their interpretation. Exercises to predict trends of the outcrop of Horizontal, vertical an 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.

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

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

SURVEYING

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

B.Sc. APPLIED GEOLOGY

SEMESTER - III

CORE III - PALAEONTOLOGY

Unit I

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

Unit II

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

Unit III

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

Unit IV

Phylum Brachiopoda:- General morphology – Brachial skeleton – morphometric details, ornamentation , classification , geological history. Phylum Echinodermata: Class Echinoidea: General morphology, corona (Ambulacra, inter ambulacra) – peristome – regular and irregular echinoids – classification– geologicial history. Class Crinoidea:- General morphology , classification, geological history. Class Blastoidea: General morphology.

Unit V

Phylum protozoa – Order,: Foraminifera: General morphology – dimorphism – classification, geological history and stratigraphic importance. Class Crustacea:- Sub class: Ostracoda – morphology – classification and geological history. A brief outline of the classification of vertebrates. A short account of Devonian fishes,

Mesozoic Reptiles, Siwalik mammals. General classification of plant kingdom – plant fossils from India – A brief account of the following plant fossils :- Glossopteris, Gangamopteris, Ptilophyllum, Calamites, Lepidodendron and Sigillaria. Applications of Micro palaeontology

TEXT BOOKS

1. Henry woods: Inveretebrate palaeontolgy – 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 Stanely, M.S.: Principles of Palaeontology, CBS Publishers.

2. Moore , R.C., Laliker , C.G.& Fishcher, A.G.: Invertebrate Fossils , Harper brothers

3. Shrock. R.R. and Twenhofel , W.H – 1953 : Principles of invertebrate Palaeontology, Amold publication Easton - Invertebrate Paleontology

B.Sc. APPLIED GEOLOGY

SEMESTER-IV

CORE IV - STRATIGRAPHY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

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

TEXTBOOKS

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

REFERENCE BOOKS

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

B.Sc. APPLIED GEOLOGY

SEMESTER-IV

CORE PRACTICAL - II

PALAEONTOLOGY AND STRATIGRAPHY

PALAEONTOLOGY

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

MICRO FOSSILS:-

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

DIAGRAMS:-

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

Stratigraphy : Arranging the different Indian Stratigraphic horizons in accordance with age, Stratigraphic position, fossil content and order of superposition.

B.Sc. APPLIED GEOLOGY

SEMESTER-IV

CORE V - CRYSTALLOGRAPHY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

Study of the symmetry elements and forms of the Normal classes of the Monoclinic and Triclinic systems with special reference to well developed crystals of Gypsum, Orthoclase, Albite, Augite, Axinite and Kyanite. Twin crystals – Definitions – Effects of Twinning – laws of twinning – composition plane, twinning plane and twinning axis, indices of twins – simple and repeated (polysynthetic twins), contact and

penetration twins: secondary twins. Study of twin laws pertaining to the following crystals – Fluorite (spinel law), Pyrite (iron cross twin). Rutile (geniculate), Calcite, Quartz (Brazil law), Aragonite (mimetic twin), Staurolite (cruciform), Gypsum, Augite and Feldspars (Carlsbad, Baveno , Manebach, Albite and Pericline).

TEXT BOOKS

1. Dana, F.S.(1955): A text book of mineralogy - Asia Publishing House - Willey.

2.Wade., F.A. & Mattox, R.B. : Elements of crystallography and mineralogy, Harper Bros.(1960)

3.Phillips, P.C (1956): An introduction to crystallography Longmans green & co.,

4. Kerr.P.F : Optical Mineralogy.

REFERENCE BOOKS

1. Phillips, W.R.: Optical Minerlogy,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.

B.Sc. APPLIED GEOLOGY

SEMESTER-V

CORE VI - MINERALOGY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

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

REFERENCES AND TEXTBOOKS

1. Berry, L.G., Mason, B.H and R.V. Dietrich (1983). Mineralogy: Concepts, Descriptions, Determinations. W.H. Freeman & Co., 612p.
2. Dana, E.S (2011). A Text-Book of Mineralogy, Read Books Design Publishers, London.
3. Dana, J.D (2012). Manual of Mineralogy, Merchant Books Publilshers, New York.
4. Erni, H (2010). Mineralogy Simplified, Forgotten Books Publishers, London, 436
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.

B.Sc. APPLIED GEOLOGY

SEMESTER-V

CORE VII - IGNEOUS PETROLOGY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

REFERENCE AND TEXTBOOKS

1. Tyrrel, G.W. (1978) The principles of petrology – Chapman and Hall Ltd., London.
2. Bowen, N.L. The Evolution of the Igneous Rocks – Dover publication, Inc, New York.
3. Barth, FW. (1962) Theoritical petrology - Wiley.
4. Walstrom, E.E. (1961) Theoritical 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 Rocks.

B.Sc. APPLIED GEOLOGY

SEMESTER-V

CORE VIII - SEDIMENTARY AND METAMORPHIC PETROLOGY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

REFERENCE AND TEXTBOOKS

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

B.Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE IX - ECONOMIC GEOLOGY

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

TEXT BOOKS AND REFERENCE BOOKS

1. Bateman Allan (1962) M. Economic Mineral Deposits, Asian Publishing House, 2nd Edition.

2. Lindgren W.(1993)Mineral Deposits, Mc Graw Hill.

3. Coggin, B. and Dey, A.K.(1955)India's Mineral Wealth.

4. Park, C.F. and Macdiarmid, R.A (1970) Ore deposits, Freeman.

5. Krishnaswamy ,s. India's Mineral Resources, Oxford and IBH.

6. Deb.S. (1980), Industrial Minerals and Rocis of India, Allied.

7. Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India, their distribution and processing, Thosmson press.

B. Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE X - PHOTOGEOLOGY AND REMOTE SENSING

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

REFERENCES AND TEXTBOOKS

1. Curran,P.B. (1985). Principles of Remote Sensing. ELBS. London.
2. Drury,S.D. (1993). Image Interpretation in Geology. Allen & Unwin. London.
3. Miller,V.C. (1961). Photogeology. McGraw Hill. New York.
4. Pandey,S.N. (1989). Principles and Applications of Photogeology. Wiley Eastern. Delhi.
5. Sabins,F.F. (1974). Remote Sensing Principles and Interpretation. Freeman. New York.
6. Reddy,A. (2010). Principles of Remote Sensing and GIS. CBS. Delhi.
7. Guptha,R.P. (2003). Remote Sensing Geology. Springer. New Delhi.
8. Lillisand,T.M & R.W.Kiefer. (2000). Remote Sensing and Image Interpretation. Wiley.

B. Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE XI - MINING AND ENGINEERING GEOLOGY

Unit I

Sampling – Principles – types – collection of sample – core samples and their preservation. Drilling – brief account of different types of drilling – Geological logging of borehole samples. Methods of breaking rocks – A short note on explosives. Surface mining open cast. Alluvial mining: Panning – Sluicing – Hydraulicking – Dredging - mine support and stoping – shaft sinking.

Unit II

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

Unit III

Introduction to Mineral Economics; Essential critical and strategic minerals Demand and Supply National Mineral Policy – Problems and Prospects – Industrial policy Resolutions, 1956 – Schedule – A, Schedule – B, Energy policy, Forest policy. Evolution of National Mineral policy – Ideal Scope of a mineral policy – Categories of minerals for grant of concessions – Minor minerals – Major minerals. Procedure for obtaining mineral concession – Termination, surrender and Determination of mining lease – The oil fields (Regulation & Development) Act, 1948 – The mines & minerals (Regulation &Development) Act, 1957 – Mineral concession Rules, 1960 – The mining leases (Modification of terms) Rules, 1956 – Minerals conservation and development Rules, 1958. The Coal mines Act, 1974 – The Atomic energy Act, 1957 – The Atomic energy Act, 1962 – The mines Act, 1952 – Mines Rules, 1955 – Coal mines Regulation , 1957 – Metaliferous mines regulation, 1961 – Mineral Taxation andIncentive measures – Incidence of Taxes – Incentive measures – Depletion Allowance – Simplification of Taxation laws.

Unit IV

Definition and scope of Engineering Geology. Engineering properties of rocks. Soils: definition and engineering properties. Geological Investigations in engineering sites. Slope stability: definition, slope failure and safety, geological factors, groundwater conditions and remedial measures. Dams: definition, types, geological conditions, and site investigations. Short note on dam foundations and geological conditions. Outline of important Indian Dams. Reservoirs: definition, selection of reservoir sites, and groundwater conditions. Problems in reservoirs: sedimentation, slope control, leakage and seismicity. Short account of Indian reservoirs.

Unit V

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

TEXT BOOKS AND REFERENCE BOOKS

1. R.N.P. Arogyasamy, Courses in mining Geology, Oxford & IBH Publishing Co.

2. Mckinstry- Mining Geology.

3. K.K. Chatterjee -An Introduction to Mineral Economics.

4. R.K. Sinha & N.L. Sharma- Mineral Economics.

5.Thomas R.T. (1979) – An Introduction to Mining – Methun.

REFERENCE AND TEXT BOOKS

1. Bell,F.G.(2005).Fundamentals of Engineering Geology. B.S.Publications. Hyderabad.

2. Krynine,P.D. & W.R. Judd.(1956). Principles of Engineering Geology & Geotechnics. CBS. Delhi.

3. Legget,R.F. & A.W.Hatheway.(1988). Geology and Engineering. 3 rd ed. McGraw Hill. New York.

4. Blyth,F.G.H. & M.H.De Freitas.(1984).A Geology for Engineers. 7th ed. Elsevier. New Delhi.

5. Parbin Singh,B.(2005). A Textbook of Engineering and General Geology. S.K.Kataria & Sons.Delhi.

B.Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE XII - HYDROGEOLOGY AND ENVIRONMENTAL GEOLOGY

Unit I

Definition of hydrogeology and groundwater – Types of groundwater based on origin - Hydrological cycle - Vertical distribution of ground water – Springs: types, geological conditions favouring development of springs - Definition of aquifers, aquitards and aquicludes - Types of Aquifers: unconfined, semi-confined, confined and perched – Artesian wells. Rock properties affecting groundwater: types of openings, porosity, specific yield, specific retention and permeability – Groundwater movement – Darcy's law and its applications – Determination of permeability in field and lab – Groundwater occurrence in igneous, sedimentary and metamorphic rocks.

Unit II

Groundwater exploration by electrical resistivity method – Outline of dug wells, tube wells, jetted wells, infiltration galleries and collector wells – Well design and development – Fluctuations of groundwater – Groundwater recharge methods. Sea water intrusion: causes, consequences and, preventive and control measures – Groundwater resources of Tamil Nadu including its quality, Ground water quality in various rock types – Parameters considered for assessing groundwater quality suitability for drinking and irrigation purposes – The latest drinking and irrigation water standards of WHO and BIS – Waterborne diseases .

Unit III

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

Unit IV

Environmental Geology : Earth's place in space. Fundamentals concepts of Environmental Geology: Human Population Growth - Sustainability - Earth as aSystem - Hazardous Earth Processes - Scientific Knowledge and Values. Internal Structure of Earth and Plate Tectonics - Plate Tectonics & Environmental Geology. Minerals and Rocks. Ecology and Geology. Natural Hazards: Hazards, Disasters, and Nature Processes - Evaluating Hazards: History, Linkages, Disaster Prediction, and Risk Assessment - Fundamental principles concerning Nature Hazards - Human response to Hazards - Global Climate and Hazards - Population Increase, Land - use Change and Nature Hazards. Volcanoes and Earthquakes: Earthquakes: Magnitude and intensity. Plate boundary related Earthquakes - Earthquake processes (Faulting, Tectonic group). Earthquake shaking (seismic waves, seismograph) -Earthquake cycle - Earthquake caused by Human Activity- Effects of Earthquakes – Tsunami - Earthquake risk and Earthquake prediction - Earthquake warning system. Volcanic activity - Volcanic Hazards, Forecasting volcanic activity. Landslides: Human use Landslide - Minimising the Landslide Hazards- Perception of Landslides,

Unit V

River, Flooding, and Coastal Hazards: Rivers and Flooding: Sediments in River - River velocity, Discharge, Erosion, and Sediments deposition- Effects of Land - use Change - Channel Pattern & Floodplain Formation - River Flooding - Urbanisation & Flooding- The Nature and Extent of Flood Hazards - Adjustments to Flood Hazards - Perception of Flooding. Coastal processes: Erosion - Coastal Hazards & Engineering structure - Human activity and Coastal erosion - Perception of and Adjustment to Coastal Hazards. Resources and Pollution: Water Resources: A brief global prospective surface water – Groundwater - Interactions between surface water and Ground water - Desalination – Water Managements - Water and Ecosystem. Water Pollution: Selected Water Pollutions – Oxygen - Demanding Waste - Pathogenic Organisms - Nutrients - Toxic Substances - Synthetic Organic Chemicals – Heavy Metals - Surface Water Pollution and Treatment- Point Source and Non-point Source - Ground water Pollution and Treatment. Mineral resources: Mineral of Human use - Geology of Mineral Resources - Environmental Impact of Mineral Development - Recycling Mineral Resource Energy. Geothermal Energy.

REFERENCE AND TEXTBOOKS

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

REFERENCES AND TEXTBOOKS

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

B.Sc. APPLIED GEOLOGY

SEMESTER-VI

CORE PRACTICAL - III

CRYSTALLOGRAPHY AND MINERALOGY

CRYSTALLOGRAPHY CRYSTAL MODELS

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

SIMPLE TWIN MODELS

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

MINERALOGY

Megascopic Mineralogy:

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

Microscopic Mineralogy :

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

Blow Pipe :

Identification of the following mineral powders by simple blow pipe tests: Apatite, Barite, Calcite, Celestite, Cerusite, 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 IV - ECONOMIC GEOLOGY AND PETROLOGY

ECONOMIC GEOLOGY

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

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

PETROLOGY

Megascopic identification of the following rocks :

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

Microscopic identification and description of the following rocks :

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

B.Sc. APPLIED GEOLOGY

SEMESTER - I

SKILL BASED ELECTIVE COURSE

SBEC - I - PRINCIPLES OF SURVEYING

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 - Bowditich'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. Zamir Alvi - A Text book of Practical geography.
4. Pijushkanti Saha and Partha Basu - Advanced Practical geography.

B.Sc. APPLIED GEOLOGY

SEMESTER - II

SKILL BASED ELECTIVE COURSE

SBEC II - REMOTE SENSING AND GIS

Unit I

Remote Sensing: 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.

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 Willy 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 Photog ram me try, McGraw Hill, New York.

B.Sc. APPLIED GEOLOGY

SEMESTER - III

SKILL BASED ELECTIVE COURSE

SBEC III - CARTOGRAPHY

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 modem trends in cartography.

Unit II

Map drawing and Measuring Techniques - Map Setting – The Earth and System of Co-ordinates - 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.

B.Sc. APPLIED GEOLOGY

SEMESTER - IV

SKILL BASED ELECTIVE COURSE

SBEC IV - FIELD HYDROGEOLOGY AND TECHNIQUES

Unit –I

Importance of Hydrology – Difference between Hydrogeology and Hydrology, Water bearing geologic formations. Ground water provinces of Tamil Nadu. Collection of rain fall data. Short account on Thiessen Polygon isohyetal maps.

Unit –II

Hydrogeologic parameters: Calculation of Porosity and Permeability, Pumptest data, calculation of ground water fluctuations.

Unit - III

Wells – Well inventory survey: water level, water level fluctuation, subsurface layers (Soil thickness, weathered zone, Fractured zone, Bed rock) - Well construction - Well logging - Sedimentary aquifers: Sandstone, limestone.

Unit – IV

Hard rock aquifers: charnockites, Gneiss, Granite formation - Field observation and measurement of soil moisture zone, zone of aeration, zone of saturation.

Unit – V

Pumping Test: Yield, drawdown, recuperation, Transmissivity, Permeability. Case studies: Rainfall in Salem district, Groundwater condition in Salem district. Rain Water Harvesting.

TEXT BOOKS:

1. A Text book of Groundwater – 2000 – P.Arul, Dhanam Agency, 99D, Bazaar Street, Virudachalam – 606 001.

2. Groundwater Hydrology – 1959 – David K. Todd – John Willey & Sons, New York.

3. Ragunath. H.M. 1987, Groundwater, Wiley Eastern Ltd., New Delhi.

B.Sc. APPLIED GEOLOGY
SEMESTER - V
SKILL BASED ELECTIVE COURSE
SBEC V - GEOSTATISTICS AND COMPUTER APPLICATIONS

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 kurtoisis, addition, multiplation 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

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 softwares 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.,

Reference Books

1. 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.
2. Robert L. Miller (1982), Statistical analysis in the Geological Sciences, John Wiley and Sons, New York.
3. Palk S.K. (1998) Statistics for Geoscientist Techniques and Applications.
4. Gregory, S (1963) Statistical Methods and the geographer Long man & London.

B.Sc. APPLIED GEOLOGY

SEMESTER - V

SKILL BASED ELECTIVE COURSE

SBEC VI - GEMOLOGY AND GEMSTONE EVALUATION

Unit – I

Definition and scope of gemology – 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 – regractometer – 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 equipment and instruments. Feasibility and economics of gem industries in India with special refrence to Tamil Nadu. 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.

Referance & Text Book

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 . , Houre,R . A abd zussman.S.(1992).An introduction to rock forming minerals,ELBS,London.
4. Kerr, P.F.(1997). Optical mineralogy, 4th Ed. McGraw Hill Book & Co New York.

B.Sc. APPLIED GEOLOGY

SEMESTER - VI

SKILL BASED ELECTIVE COURSE

SBEC VII - GRANITE EXPLORATION AND EXPLOITATION

UNIT-I

Building Stones. Basic properties of building and dimensional stones. Types of Granites and their commercial terminologies. Granite rock exploration.

UNIT-II

Mining methods of Granites - Marking methods. Methods of cutting and polishing of Granites.

UNIT III

Methods of exploration: Geological and Geophysical methods. Important rocks of Granite Industries – Granites and Marbles.

UNIT IV

Machineries used in Granite Industries – Wire saw machine, Cutting and Polishing Machines.

UNIT-V

Marketing, pricing and Export of Granites. Granites and granite industries of India and Tamilnadu. End uses of Granite wastes.Manufacture Sand

Reference:

1. Courses in Mining geology –RPN Arogyasamy- John Wiley Eastern Pub
2. Economic minerals –U.Prasad-CBS
3. An introduction to Mineral Economics-KK Chattejee-John Wiley Eastern Pub
4. Mineral Economics-RK Sinha & NL Sharma-Oxford & IBH
5. Field Geology-Mathur

B.Sc. APPLIED GEOLOGY

SKILL BASED ELECTIVE COURSE

SBEC VIII - MINES AND MINERALS LEGISLATION OF INDIA

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 — Metaliferous mines regulation, 1961 – Mineral Taxation and Incentive measures – Incidence of Taxes – Incentive measures – 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

B.Sc. APPLIED GEOLOGY

SKILL BASED ELECTIVE COURSE

SBEC IX - INTRODUCTION TO GEOINSTRUMENTATION

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 : PH & 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. 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

B.Sc. APPLIED GEOLOGY

SKILL BASED ELECTIVE COURSE

SBEC X - WATER QUALITY ANALYSIS

Unit – I

Physical properties of water: Colour, odour, taste, temperature, turbidity & viscosity. Methods of analysis of physical properties. World Health Organisation (WHO) and Bureau of Indian Standards (BIS).

Unit – II

Chemical properties of water: PH-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 pH – 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.

References

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.(1878) 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 Federation, New York.

B.Sc. APPLIED GEOLOGY

SKILL BASED ELECTIVE COURSE

SBEC XI -MAPPING TECHNIQUES IN GEOLOGY

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 – cross section – order of superposition.

Referance

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, 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.
5. Lahee, F.H(1961).Field Geology, CBS, Delhi.
6. Davis,G.H (1985).Structural Geology of rocks and regions, Wiley,New York.
7. McClay,(1995).Mapping of Geological Structures. Geological Soc. Publication House Barth, U.K.

B.Sc. APPLIED GEOLOGY

SKILL BASED ELECTIVE COURSE

SBEC XII - GEOLOGY FOR COMPETITIVE EXAMINATIONS

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) vem 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

1. Julka and Ravi Misra (2003). Geoinforma – 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 quides, chapman &Hall
4. Srivastava, 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.

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC I - OCEANOGRAPHY

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.

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC II - CLIMATOLOGY

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 - Corialies 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

1. Critchfield, H., (1975): General Climatology, Prentice-Hall, New York.
2. Das, R. K., (1968): The Monsoons, National Book Trust, New Delhi.
3. Mather, J. R., (1974): Climatology, McGraw Hill, New York.
4. Patterson, S., (1969): Introduction of Meteorology, McGraw Hill Book Co., London.
5. Stringer, E. T., (1982): Foundation of Climatology, Surjeet Publications, New Delhi.
6. Trewartha, G. T., (198): An Introduction to Climate, International Students Edition, McGraw Hill, New York.
7. Kumaraswamy. K., et. al., (2003) : Climatology (Tamil Edition), Grace Publishers, Kumbakonam.

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC III - BASIC GEOCHEMISTRY

Unit - I

Orgin, 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-electronegativity-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- Gravimetry – chromotography-flame photometry-DTA.

Reference:

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,4rd Ed,Wiley,New York.
3. Rollinson,H,(1993), Using Geochemical Data evaluation, preparation and interpretation, Longman, Singapore.
4. Gill, R. C. (1997),Chemical fundamentals of Geology, Chapman & Hall, U.K.

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC IV - BASIC GEOPHYSICS

Unit I

Definition and scope of geophysics. Gross geophysical properties of Earth: Surface gravity variation, electrical and magnetic properties of rock.

Unit II

Seismic properties of rocks, Densities of various layers of earth (Lithosphere). Distribution of density and pressure within earth.

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 paleomagnetism.

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.

References

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

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC V - GEOHAZARDS

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 – Windstrorms – Lightening – Drought – Frost and Freezes – Wild Fire

Unit – V

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

Suggested Books

1. Montgomery, C.W (2008) Environmental Geology, Mc Graw Hill 8th Edition
2. Abbott, Patrick, L(2006) Natural Disasters, Mc Graw Hill, Boston, MA
3. Bryant, E (2005) Natural Hazards, Cambridge University Press, Cambridge, U.K.

B.Sc. APPLIED GEOLOGY

NON MAJOR ELECTIVE COURSE

NMEC VI - GROUNDWATER MANAGEMENT AND RAINWATER HARVESTING

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.

References

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., DeWiest, R.J.M.(1979) Hydrogeology, John Wiley, New York.
6. Freeze, R.A., Cherry, J.A. (1979) Ground Water, Prentice Hall, New Jersey.

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 Tamilnadu it include, mine visit, geological mapping, minerals, rocks collection and display at the time of their practical examination for internal evaluation. The duration may be for two weeks.

B.Sc. APPLIED GEOLOGY

ALLIED GEOLOGY –I

Unit I

General Geology: Definition and scope of Geology. Origin of solar system: Nebular and Planetesimals 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 of 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 center 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.

B.Sc. APPLIED GEOLOGY

ALLIED GEOLOGY –II

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 Tiruchirapalli,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.

B.Sc. APPLIED GEOLOGY

ALLIED GEOLOGY PRACTICAL

Code:

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 sections for conformable series of beds.