BHARATHIDASAN UNIVERSITY TIRUCHIRAPPALLI - 620 024.

B.Sc. GEOLOGY

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2022-23 onwards)

(NAAN MUDHALVAN SCHEME was implemented from 2nd to 6th Semester)

Sem.	Part	Types of the Courses		Ins. Hrs	Credits	Exam Hours	Marks		Total
							Int.	Ext.	
I	I	Language Course – I Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course - I		6	3	3	25	75	100
	III	Core Course – I (CC)	Dynamic Geology	5	5	3	25	75	100
		Core Course – II (CC)	Structural Geology	5	5	3	25	75	100
		First Allied Course – I (AC)		4	4	3	25	75	100
		First Allied Course – II (AC)		2	-	-	-	-	-
	IV	Value Education		2	2	3	25	75	100
	TOTAL			**30**	**22**	**-**	**-**	**-**	**600**
II	I	Language Course - II Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course - II		4	3	3	25	75	100
	III	Core Course – III (CC)	Palaeontology	5	5	3	25	75	100
		Core Practical – I (CP)	Structural Geology	4	4	3	40	60	100
		First Allied Course – II (AC)		3	2	3	25	75	100
		First Allied Course – III (AC)		4	4	3	25	75	100
		Add on Course – I ##	Professional English – I	6*	4	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Language Proficiency for Employability - Effective English	2	2	3	25	75	100
	TOTAL			**30**	**29**	**-**	**-**	**-**	**900**

III	I	Language Course – III Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course - III		6	3	3	25	75	100
	III	Core Course – IV (CC)	Physical Geology	5	5	3	25	75	100
		Core Practical - II (CP)	Palaeontology	4	4	3	40	60	100
		Second Allied Course – I (AC)		4	4	3	25	75	100
		Second Allied Practical – II (AP)		3	-	-	-	-	-
		Add on Course – II ##	Professional English - II	6*	4	3	25	75	100
	IV	Non-Major Elective I @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10th & 12th std		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Digital Skills for Employability – Microsoft Digital Skills	-	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**800**
IV	I	Language Course –IV Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course – IV		6	3	3	25	75	100
	III	Core Course - V (CC)	Crystallography	5	5	3	25	75	100
		Core Practical - III (CP)	Crystallography	4	3	3	40	60	100
		Second Allied Practical – II (AP)		3	2	3	40	60	100
		Second Allied Course – III (AC)		4	4	3	25	75	100
	IV	Non-Major Elective II @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10th & 12th std		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NM) @@	Employability Skills - Employability Skills	-	2	3	25	75	100
	TOTAL			**30**	**24**	**-**	**-**	**-**	**800**

V	III	Core Course -VI (CC)	Mineralogy	5	5	3	25	75	100
		Core Course – VII (CC)	Stratigraphy	5	5	3	25	75	100
		Core Course – VIII (CC)	Mining Geology	5	5	3	25	75	100
		Core Practical – IV (CP)	Mineralogy	4	4	3	40	60	100
		Major Based Elective – I (Any one)	1. Engineering Geology 2. Exploration Techniques	5	4	3	25	75	100
	IV	Skill Based Elective I	Field Geology	4	2	3	25	75	100
		Soft Skills Development		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Marketing & Design Tools – Digital Marketing	-	2	3	25	75	100
	TOTAL			**30**	**29**	**-**	**-**	**-**	**800**
VI	III	Core Course - IX (CC)	Petrology	6	5	3	25	75	100
		Core Course - X (CC)	Economic Geology	6	5	3	25	75	100
		Core Practical – V (CP)	Petrology and Economic Geology	4	4	3	40	60	100
		Major Based Elective – II (Any one)	1. Hydrogeology 2. Environmental Geology	5	4	3	25	75	100
		Project		4	3	-	20	80	100
	IV	Skill Based Elective – II	Remote Sensing	4	2	3	25	75	100
	V	Gender Studies		1	1	3	25	75	100
		Extension Activities*		-	1	-	-	-	-
	VI	Naan Mudhalvan Scheme (NMS) @@	Career Readiness Programme	-	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**800**
GRAND TOTAL				**180**	**158**	**-**	**-**	**-**	**4700**

List of Allied Courses

First Allied Course	**Second Allied Course**
Mathematics	**Chemistry / Physics**

$ For those who studied Tamil upto 10th +2 (Regular Stream).

+ Syllabus for other Languages should be on par with Tamil at degree level.

Those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part- I should study special Tamil in Part – IV.

The Professional English – Four Streams Course is offered in the 2nd and 3rd Semester (only for 2022-2023 Batch) in all UG Courses. It will be taught apart from the Existing hours of teaching / additional hours of teaching (1 hour /day) as a 4 credit paper as an add on course on par with Major Paper and completion of the paper is must to continue his / her studies further. (As per G.O. No. 76, Higher Education (K2) Department dated: 18.07.2020).

* The Extra 6 hrs / cycle as per the G.O. 76/2020 will be utilized for the Add on Professional English Course.

@ NCC Course is one of the Choices in Non-Major Elective Course. Only the NCC cadets are eligible to choose this course. However, NCC Course is not a Compulsory Course for the NCC Cadets.

** Extension Activities shall be outside instruction hours.

@@ Naan Mudhalvan Scheme.

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	I	Language Courses	4	12	400
2.	II	English Courses	4	12	400
3.	III	Core Courses	10	50	800
4.		Core Practical	5	19	700
5.		Allied Courses I & II	4	16	400
6.		Allied Practical	2	4	200
7.		Major Based Elective Courses	2	8	200
8.		Add on Courses	2	8	200
9.		Project	1	3	100
10.	IV	Non-Major Elective Courses (Practical)	2	4	200
11.		Skill Based Elective Courses	2	4	200
12.		Soft Skills Development	1	2	100
13.		Value Education	1	2	100
14.		Environmental Studies	1	2	100
15.	V	Gender Studies	1	1	100
16.		Extension Activities	1	1	--
17.	VI	Naan Mudhalvan Scheme	5	10	500
	Total		**48**	**158**	**4700**

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First Year	**CORE COURSE I**	**Semester I**
	Dynamic Geology	
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To learn about the basic principles of Geology, Solar system, Earthquakes, Mass movements like Soil creep, Rock Creep and Solifluction, Earth's various exogenetic processes like weathering and action of geological agents and Endogenetic processes like earthquake, volcanoes, tectonic process and mountains.

UNIT I:

Definition of Geology – Branches of Geology – The Solar system:– Origin of Earth - Nebular hypothesis – Planetesimal hypothesis – Tidal hypothesis – Von Weiszacker's hypothesis - Dust Cloud hypothesis - Big bang theory. Detailed study of the structure and composition of Earth's interior - Age of the earth – sedimentation method - salinity method.

UNIT II:

Earthquakes: Definition — Focus and Epicenter – Magnitude and Intensity – Properties and propagation of seismic waves – Seismograph and Seismogram – Distribution of Earthquakes in India–-Prediction of Earthquakes – Tsunami.

UNIT III:

Volcanoes: Definition – Types, –Distribution of volcanoes, Causes of volcanism – Effects of Volcanic activity - Prediction of volcanoes.

UNIT IV:

Distribution of continents and Oceans –Continental drift: Wegner's and Taylor's hypothesis-Merits and demerits of drift theories; Seafloor spreading- Concept of plate tectonics – Different kinds of plate margins.

UNIT V:

Mountains: Classification – Life cycle of mountains – Origin of mountains. Geosynclines: Stille's, Kay's, Strahler's and Schuchert's Classifications; Types of plateaus and plains. Causes, effects and evidences of Sea level changes.

UNIT VI: CURRENT CONTOURS (for Continuous Internal Assessment Only):

Tectonic zones of the world – Recent Earth quakes and volcanic eruption.

REFERENCES:

1. Arthur Holmes (1992) Principles of Physical Geology: Thomas Nelson & sons

London.
2. Philip G. Worcester (1939) A textbook of geomorphology: D. Van Nostrand co., London.
3. Radhakrishanan. V (1966).General Geology - V.V.P. Press.
4. Mahapatra, G.B. (2015) A text book of Geology(- CBS, Delhi
5. Patwardhan, A.M. (2012) The Dynamic Earth System - PHI Learning PVT. Ltd, NewDelhi
6. William J. Miller (1949) -Principles of physical Geology - Thomas Nelson & sons, London.
7. W. D. Thornbury (1969) A text book of geomorphology - D. Van Nostrand co., London.
8. A.L. Bloom (1978) General Geology - V.V.P.Press.
9. L.D. Leet & Judson (1960) Physical Geology - Prentice Hall, India.
10. Edger W. SpencerEarth Science (2002) -Mc Graw Hill, New Delhi.
11. Richard John Huggett,2016, Fundamentals of Geomorphology,Taylor and francis, Fourth edition
12. Vishwas .s.kale and Avijit Gupta, 2018, Introduction to Geomorphology, The orient black swan Publications
13. Michael A.Summerfield, 2011Geomorphology and global tectonics, John Willey Publications
14. Siva Nand Jha,2021, A Handbook of Geomorphology, Shree Navman Publications
15. Ajit kumar sil, 2021, Global tectonics and Geomorphology, Himalayan books

COURSE OUTCOME:

To know about the major geological process that happens in and around the earth.

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First Year	**CORE COURSE II**	**Semester I**
	STRUCTURAL GEOLOGY	
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

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

UNIT I:

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

UNIT II:

Primary and Secondary Structures-Primary Structures of extrusive and intrusive igneous rocks- Primary structures of sedimentary rocks. Plutons-concordant and discordant plutons—dyke-sill-phacolith-lopolith-batholith,ring dyke and cone sheets-brief study of salt domes.

UNIT III:

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

UNIT IV:

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

UNIT V:

Definition and features of Foliation – Primary and secondary foliations; Cleavage and Schistosity. Lineation; Mechanism and Uses of Clinometer and Brunton compass.

UNIT VI: CURRENT CONTOURS (for Continuous Internal Assessment Only):

Major structural features, its distribution and importance in natural resources and disaster mapping.

REFERENCES:

1. Billings, M. P. (1974), Structural Geology: Prentice Hall, Englewood Clifts, U.S.A.
2. Novin, C. M. (1953), Principles of structural Geology John Willey, New York.
3. Gokhale, N. W. (2013): Theory of Structural Geology. CBS Publishers.
4. Ghosh, S. K. (1993), Fundamentals and Modern developments. Pergamon Press.
5. V.V. Belousov (1962)- Structural Geology, Moscow
6. P.C. Bedgley (1965)- Structural and Tectonic, Principles: Harper & Row, New york.
7. E.W. Spencer (1977), An Introduction to structural Geology: Mc Graw, Hill, New York.
8. Park, P.G. (2011) Fundamentals of structural Geology, John Willey & sons,
9. Ajit k sil,2018,Geotectonics and geomorphology vol 1,The himalyan books
10. Tarling, 1981, Economic Geology and geotectonics, Halstead Press
11. Palmer andredw, 2022, Structural Geology and tectonics , Oxford book company
12. Hatcher, Robert d Christopher Bailey, 2019, Structural Geology, principles, concepts and problems , Oxford univ press
13. Pearson, 2017, Basic methods of structural geology ,Pearson education

COURSE OUTCOME:

Acquire knowledge on different types of structures, its formation and its causes and further useful for earth's dynamic study.

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First Year	CORE COURSE III PALAEONTOLOGY	Semester II
Code:	(Theory)	Credit: 5

COURSE OBJECTIVE:

To study about the Palaeo life in the world, General morphology and Applications of Micro Palaeontology

UNIT I:

Definition of fossils – nature and modes of preservation of fossils: Petrifaction, carbonisation, silicification; - mould, casts, tracks, trails, borings; Uses of fossils – index fossils –

UNIT II:

Phylum Mollusca: Class Pelecypoda - General characters –Class Gastropoda:- General morphology,. Class Cephalopoda: General morphology, (Nautilitic, Gonioatitic, Ceratitic and Ammonitic) –. Phylum Arthropoda: Class – Trilobita- General morphology.

UNIT III:

Phylum Coelentrata – class Anthozoa – General morphology: classification – Graptozoa: order Dendroidea and Graptoloidea. Phylum Echinodermata: Class Echinoidea: General morphology, classification Phylum Brachiopoda:- General morphology –classification

UNIT IV:

Phylum protozoa – Order: Foraminifera: General morphology – classification, geological history and stratigraphic importance.. Applications of Micro Palaeontology.

UNIT V:

Outline of the classification of Vertebrates- Devonian fishes, Mesozoic Reptiles, Siwalik mammals. General classification of plant kingdom – plant fossils: Glossopteris, Gangamopteris, Ptilophyllum, Lepidodendron.

UNIT VI: CURRENT CONTOURS (for Continuous Internal Assessment Only):

Evolution of various species in accordance with different geological time scale.

REFERENCES:

1. Henry woods (1961): Inveretebrate palaeontolgy – Cambridge.
2. Romer, A.S. (1966): Vertebrate palaeontology, Chicago press.
3. Arnold, C.A., (2008): 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., (1983) (An introduction to Paleontology, Vishal Publications.
6. Raup, D.M. and Stanely, M.S. (2006): Principles of Palaeontology, CBS Publishers.
7. Moore, R.C., Laliker, C.G.& Fishcher, A.G.(1952): Invertebrate Fossils, Harper brothers
8. Shrock. R.R. and Twenhofel, W.H – (1953) : Principles of invertebrate Palaeontology, Amold publication Easton - Invertebrate Paleontology
9. David bainbridge, 2022, paleontology and illustrated history, princeton university press
10. Charles eastman, 2020,textbook of paleontology, alpha editions
11. Susan heinrics gray, 2012 paleontology the study of pre historic life, scholastic library publishing
12. David harper and michael benton, 1997,basic paleontology, prenpice hall
13. Michael benton, 2019 dianosarus rediscover the scientific revolution in paleontology, thames and hudson

COURSE OUTCOME:

Gain knowledge on different types of fossils and its geological importance.

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First Year	**CORE PRACTICAL I STRUCTURAL GEOLOGY**	**Semester II**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVE:

To know about the Exercises to predict the trends of the outcrop of horizontal, vertical and inclined beds with respect to topography, reading of solid fold and fault, maps construction and problems relating to true dip and apparent dip. Fundamental and applications of surveying.

Structural Geology:

- Contour maps and their interpretation.
- Exercises to predict trends of the outcrop of Horizontal, vertical anticline beds with respect to topography
- Deciphering dip and strike of outcrops – construction of map with three points over a bedding plane are given construction of vertical sections
- order of super position and vertical thickness of formations
- Determination of throw of vertical faults, determination of comparative ages of structures and intrusions – narrate geological history of an area.
- Structural Problems – problems relating to true dip and apparent dip; Determination of vertical and true thickness.
- Basic map components. 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 – levelling. Clinometer Compass and Brunton Compass – GPS :Fundamentals and applications.

CURRENT CONTOURS (for Continuous Internal Assessment Only):

DGPS – Total Station surveying principles and applications.

COURSE OUTCOME:

Get a practical knowledge on the measurement and the analysis of structures in the field and map.

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Second Year	**CORE COURSE IV PHYSICAL GEOLOGY**	**Semester III**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To know about the Weathering of rocks and its processes, Source of Running water erosion, transportation and deposition of landforms, Underground water sources its formation and process, Origin of Glaciers and its type of movement, characteristics of Seas and Oceans

UNIT – I:

Weathering of Rocks – Environment of weathering – kinds of weathering processes-physical-chemical-biological weathering – Rates of weathering – products of weathering, – weather and climate – Role of weathering in Geologic cycle, Economic importance of weathering.

Atmosphere – Its composition and zones. Movement of atmosphere – wind – Geological actions of wind- formation of sand dunes and their types – loess – arid cycle of erosion – characteristics of deserts.

UNIT – II:

Running water/River– Source and surface flow – erosion, transportation and deposition land forms– valley development – river meandering. Drainage patterns – fluvial cycle; youth- maturity-old stage – stream rejuvenation – river capture-river terraces-deltas.

UNIT – III:

Underground water/Groundwater – sources – water table – zone of saturation – springs and wells – artesian wells – geysers – spring deposits – aquifer – geological work of ground water – solution – Karst topography – development of karst features – characteristics of Karst regions – origin of L.St. caverns – stalactite and stalagmite formations-artesian belts of Tamil Nadu.

UNIT – IV:

Glaciers – origin and types of glaciers – movement of glaciers – transportation and deposition – glacio fluvial deposits – land forms produced by glaciers – Ice ages. Lakes – classification – types of lakes – lake deposits. Brief study of lakes in Tamil Nadu

UNIT – V:

Waves, tides and currents– sea as a geologic agent – classification of shorelines – shoreline types – description of continental margin – continental shelf – continental slope –ocean basin. Submarine topographic- canyon-sea mounts-Guyot-mid oceanic ridge. Oceanic deposits. Coral reefs - origin and their types.

Ocean natural resources

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Flood inundation studies – water level fluctuation – melting of glaciers -sea level rises. Acquire knowledge on different types of geological agents and its land forms.

REFERENCES:

1. Philip G. Worcester (1939): A text book of Geomorphology – D. Nostrandcomp Inc. New York.
2. Radhakrishnan. V, (1996): General Geology, VVP, Tuticorin.
3. Mahapatra, G.b.(2015): A text book of Geology, CBS, Delhi
4. Arthur Holms (1993): Principles physical Geology Thomos Nelson & sons, London
5. Chakranarayanan, A.B. et.al: Concepts of Geology, Scientifica Publication
6. D. Leet & Shelton Judson (1960): Physical Geology – prentice Hall, Internation Inc. Englewood, Cliff, U.S.A.
7. William J, Miller (1949): An introduction to physical Geology, D. Van Nostrand Company, Inc New York.

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Second Year	**CORE PRACTICAL II PALAEONTOLOGY**	**Semester III**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVE:

To familiarize about various invertebrates, plant and microfossils and crystal models, Simple Twin Models.

PALAEONTOLOGY

Megascopic identification and description of the following fossils:- Corals: Calceola, Zaphrentis, 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, Perisphinctes, 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.

COURSE OUTCOME:

Gets hands-on exercise to know the different types of fossils in detail.

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Second Year	**CORE COURSE V CRYSTALLOGRAPHY**	**Semester IV**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To understand about the geometrical characters of crystals. Study of the symmetry elements, behaviour of ordinary and polarized light in petrological microscope, Optical properties of isotropic and anisotropic minerals observed under parallel and crossed Nicols.

UNIT – I:

Definition of crystal – morphological characters of crystal – faces –forms – edges solid angles – Interfacial angle. Contact Goniometer. Symmetry elements – crystallographic axes – crystal notation – parameter system of Weiss and Miller indices – axial ratio – laws of crystallography.

UNIT – II:

Classification of crystals into systems and classes - Holohedral, Hemihedral, Hemimorphic and Enantiomorphic forms in crystals.

Unit - III:

Projections: Elementary knowledge of spherical and sterographic projections.

UNIT – IV:

Study of the symmetry elements, and forms of the Normal, pyritohedral, tetrahedral and plagiohedral classes of cubic system with type minerals.

UNIT – V:

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. Twin laws.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

X-ray crystallography – XRD- Power XRD.

REFERENCES:

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 (1995): Optical Mineralogy.
5. Phillips, W.R. (1986): Optical Minerlogy, Griffen, D.T.1986.
6. Walhstrom, E.F. (1960): Optical crystallography – John wiley.
7. Winchel, A.n. (1968): Elements of optical mineralogy, part 1 & 2 wiley Eastern.
8. Smith H.G. (2011): Minerals under microscopy – Murby.
9. Christopher hammond, 2001 basics of crystallography and diffraction, oxford university press
10. Frank hoffman, 2020, introduction of crystallography, springer international publishing
11. Klaus herman, 2017, crystallography and surface structure (second edition), wiley
12. Kelly, groves, kidd , 2000,crystallography and crystal defects, wiley
13. Donald sands, 1978, introduction of crystallography, benjamin cummings
14. Walter borchardt-ott, 2011, crystallography (third edition), springer berlin heidberg

COURSE OUTCOME:

Geometric character of crystal will help to understand in detail on minerals and its origin

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Second Year	**CORE PRACTICAL III CRYSTALLOGRAPHY**	**Semester IV**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVE:

To familiarize about various invertebrates, plant and microfossils and crystal models, Simple Twin Models.

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.

CURRENT CONTOURS: (For continuous internal assessment only):

Recent exploration of various ores and minerals.

REFERENCES:

1. Frank Hoffmann , 2016,Introduction of crystallography, Springer
2. Carmelo Giacovazzo, 1992,Fundamentals of crystallography, Oxford science publisher
3. Gale Rhodes , 1993,Crystallography made crystal clear Academic press
4. Gregory Girolami , 2015,X-ray crystallography, University science books, US.

COURSE OUTCOME:

Practical knowledge on Crystals and its importance in formation of Minerals.

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Third Year	**CORE COURSE VI MINERALOGY**	**Semester V**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

To learn about the physical and optical properties of rock forming minerals. It deals in detail about the structure, physical and chemical properties of Ortho, ring, sheet, chain and framework silicates

UNIT – I:

Crystalline and amorphous substances, Physical properties of minerals (structure, form, cleavage, colour, luster, transparency, streak, hardness, sp.gravity, tenacity, feel, taste, odour). Electrical, Magnetic and Thermal Properites. Isomorphism, polymorphism and pseudomorphism,–Non-crystalline minerals.

UNIT – II:

Physical properties, chemical composition, Classification, properties and mode of occurrence of Olivine group, Garnet group, Alumino silicates-Epidote group,

UNIT – III:

Physical properties, chemical composition, Classification, Optical and mode of occurrence of Sheet silicates and Chain silicates: Mica group- Chlorite group - Pyroxene group -Amphibole group.

UNIT – IV:

Physical properties, chemical composition, Classification, Optical and mode of occurrence of Frame work silicates: Quartz group-Feldspar group, Feldspathoid group.

UNIT – V:

Physical properties, chemical composition, Classification, Optical and mode of occurrence of clay minerals—Spinel group, Carbonates and Phosphates. Properties of precious and semi-precious minerals.

UNIT - VI CURRENT CONTOURS: (For continuous internal assessment only):

Minerals and its utilities in various industries. Excavation of minerals and its impacts

REFERENCES:

1. E.S. Dana, 1935, A Text Book of Mineralogy, John Wiley & Sons.
2. L.G. Berry Mason, 1961, Mineralogy, W.H. Freeman & Co.,

3. W.A. Deer, R.A. Howie and J. Zussman, 1966, An Introduction to the Rock Forming minerals, Longmans.
4. Alexander N. Winchell, 1968, Elements of Optional Mineralogy, Parts I and II, Wiley Eastern (P) Ltd.,
5. Ernest, E. Walhstrom, 1960, Optional Crystallography, John Wiley & Sons,
6. Kerr, B.F.,1995, Optical Mineralogy5th Ed. Mc Graw Hill, New York.
7. S.Mitra, 1994, Fundamentals of Optical, Spectroscopic and X-ray Mineralogy
8. William nesse, 1999,introduction of mineralogy , qup usa
9. Arnold sergeerid marfunin , 2004,advanced mineralogy: process of mineral formation, springer
10. Sergy krivovicher, 2011,minerals as advanced materials, springer science and business media
11. Arnolds sergeevich , 1994,advanced mineralogy minerals as asource of metals energy and materials
12. Arnolds sergeevich, 1994,advanced mineralogy methods and instrumentations, springer berlin heidenberg
13. Berry mason dietrich, 1983, mineralogy(second edition), san franscisco

COURSE OUTCOME:

Helps to familiarize with the structure and composition of minerals for mineral identification

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Third Year	**CORE COURSE VII STRATIGRAPHY**	**Semester V**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To learn about the geological time scale, principles of stratigraphy and the description of strata and their relationship to tectonics, climate, fossils along with from Precambrian to recent and geological boundary problems and applications of stratigraphy.

UNIT - I:

Principles of stratigraphy: law of order of superposition. law of uniformitarianism and law of faunal succession. Correlation. - Indian Geologic Time scale. Imperfections in Geological record. Geological divisions. Stratigraphic classification -Nomenclature. Stratigraphic Units-Homotaxis. Physiographic divisions of India:

UNIT – II:

Precambrian Stratigraphy: Archaeans of Dharwar Province-Archaeans of Eastern Ghat - The Sausar and Sakoli Series-Archaeans of Singhbhum – Iron Ore 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- -Paleozoic rocks of Spiti Valley-Paleozoic rocks of Peninsular India.

UNIT – IV:

Mesozoic Stratigraphy: The Depositional Environment-distribution and economic importance of Gondwana formations of India- Gondwana formations of Tamilnadu. Triassic of Spiti -Jurassic of Kutch. Cretaceous of Tiruchirapalli – Pondicherry – Bagh Beds. Deccan traps : distribution- structure- age of the Deccan traps.

UNIT – V:

Cenozoic Stratigraphy: Comprehensive events took place during Cenozoic era in India. Rise of Himalayas-stratigraphy of Siwalik system-fauna and flora of Siwaliks. Tertiary rocks of Assam- -Tertiary rocks of Tamilnadu Outline of Mineral wealth of Tertiary rocks of India.

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):

Recent identification different formations and its age through geological time scale.

REFERENCE BOS:

1. Krishnan M.S. (2003) Geology of India and Burma, 6th Edition, CBS.
2. Wadia (1953) Geology of India, TATA McGraw – Hill. D.N.
3. Ravindrakumar K.R. (1958) - Stratigraphy of India.
4. Lemon R.Y (1990) - Principles of Stratigraphy, Merrill Publishing Co.
5. Pascoe, E.H. (1968) A manual of the Geology India and Burma, Govt of India Publications.
6. Gregory, J.W. and Barret B.H (1931) General stratigsraphy Mathuen.

COURSE OUTCOME:

Helps to understand the past geological history of earth.

*****

Third Year	**CORE COURSE VIII MINING GEOLOGY**	**Semester V**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To know about the basic principles of mining geology and various mining methods.

UNIT – I:

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

UNIT – II:

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

UNIT – III:

Subsurface mining: Criteria affecting the subsurface mining, Definition of mining terms: Shaft, Level, Adit, Hanging wall, Footwall, Drive, Cross cut, Tunnel, Raise, Winze and Chute. **–** Shrinkage stopes, Glory hole mining.

UNIT – IV:

Caving methods: Top slicing, Coal mining, Prospecting and Planning – Strip mining – Augering – Room and Pillar method – Long wall method.

UNIT – V:

Impact of Mining activities in the surround environment –Remedial measures.

UNIT – VI:

CURRENT CONTOURS: (For continuous internal assessment only):

Recent developments in mapping methods – Fully automated excavation processes.

REFERENCES:

1. Arogyaswamy, R.N.P.(1996) Courses in Mining Geology – Oxford &IBH, New Delhi.
2. Thamus, P.J. (1979) An introduction to mining, Methun.
3. Mc Kinstry, H.E (1960) Mining Geology, New York.
4. Arogyaswamy, 2017,Courses in mining Geology, Oxford & IBH publisher

Co.Pvt.ltd
5. Singh, 1997 Principles & practices of modern coal mining, Newage international publishers

COURSE OUTCOME:

Get the knowledge on different mining methods to suggest suitable method for resources exploration.

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Third Year	**CORE PRACTICAL IV MINERALOGY**	**Semester V**
Code:	**(Practical)**	**Credit: 4**

COURSE OBJECTIVE:

To know about the Megascopic and Microscopic properties and their identification of the various minerals, Identification of the mineral powders by simple blow pipe tests.

MEGASCOPIC MINERALOGY:

Description of megascopic properties and their identification of the following minerals: Quartz, Rosy quartz, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal, Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Nepheline, Leucite, Sodalite, Enstatite, Bronzite, Hypersthene, Diopside, Augite, Spodumene, Acmite, Rhodonite, Wollastonite, Anthophyllite, Tremolite, Actinolite, Hornblende, 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 Worlframite.

CURRENT CONTOURS: (For continuous internal assessment only):

Mineral wealth of Tamil Nadu and India

Reference

1. Berry Mason Dietrich , 2004,Mineralogy, CBS publisher and distributers
2. Dexter Perkins, 2015,Mineralogy, Pearson India
3. Gribble, 2005, Rutley's element of mineralogy, CBS publishers and distributers
4. Cornelis Klein & Barbare Dutrou, 2012 Mineral Science, Wiley India Pvt Ltd.

COURSE OUTCOME:

Get hands-on exercise to understand the Physical, chemical and mineralogical behaviour of minerals.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

1. ENGINEERING GEOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVE:

To know about the basic principles of engineering properties of rocks and geological investigation of engineering site selection.

UNIT – I:

Introduction to Engineering Geology: Engineering properties of rocks, Rock discontinuities, Physical characters of building, ornamental stones and Concrete aggregates.

UNIT – II:

Tunneling – Types, Methods of geological investigation. Road – complicated regions for Roads. Geological problems after road construction – improvement of sites – soil stabilization.

UNIT – III:

Role of Geology in site selection for rail road construction – runway construction – harbour construction.

UNIT – IV:

Dams and Reservoirs – Types of dams – Dam sites. Relative suitability of different rocks – Geological investigation in dam sites.

UNIT – V:

Geological investigation on landslides - Soil erosion – Earthquake and suitable site selection for civil Engineering constructions and other remedial measures for safe livelihood.

UNIT VI CURRENT CONTOURS: (For continuous internal assessment only):

M-Sand - Soil testing methods-Disaster prone areas mapping

REFERENCES:

1. Krynine, D.P. and Judd, W.R. 1957 principles of Engineering Geology and Geotochniques, Mcgraw Hill.
2. Legget, R.F. 1962 Geology and Engineering , McGraw Hill
3. Gokhale K.V.G.K and Rao, D.M. 1981 Experiments in Engineering Geology, Mcgraw Hill.
4. Fox, C.S 1949 Engineering Geology, New York
5. Blyth, F.C. 1979 A Geology for Engineers, ELBS
6. Chenna Kesavulu, 2016, Textbook of Engineering Geology, Trinity press
7. Aurele Parriaux, 2009, Geology Basics for Engineers, CRC Press
8. David George Price, 2009, Engineering Geology (principles and practise), Springer
9. K.V.G.K. Gokhale, 2016, Principles of Engineering Geology, BSP Books Private Limited.

COURSE OUTCOME:

Acquire knowledge on applications of Geology in Engineering aspects.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

2. EXPLORATION TECHNIQUES

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

To know about working principles and applications of different exploration techniques for geological investigation.

UNIT - I:

Geological Exploration: Criteria for controlling the choice of sites for geological prospecting-Marginal Information of Toposheets and study of field equipment. Field documentation and basic field procedures. Mineralogical, Structural, Stratigraphical and Geomorphological guides to ore search.

UNIT - II:

Geophysical Exploration: Limitations and applications of geophysical exploration methods-Electrical methods- Self potential method- Electrical Resistivity method- Induced Polarization method- Electromagnetic method- Well logging techniques

UNIT - III:

Gravity methods: Density logging - Seismic methods: Seismic Refraction and Seismic Reflection - Sonic logging techniques.

UNIT - IV:

Magnetic Methods:Concepts and principles of magnetic prospecting-magnetism of Earth and Palaeomagnetism; Radioactive Method: Radioactive decay-Radioactivity of rocks and minerals-radioactive survey.

UNIT - V:

Geochemical Exploration: Origin and abundance of elements in the earth's crust-Mobility of elements-geochemical dispersion-Geochemical anomaly-Application of Geochemistry in Georesources exploration-Outline of biogeochemical exploration.

UNIT - VI CURRENT CONTOURS: (For continuous internal assessment only):

Working Principles and applications of 3D Geophysical exploration instruments.

REFERENCES

1. Inverse and Risk Method in Hydrocarbon Exploration " by I Lerche
2. "Hydrocarbon Exploration to Exploitation West of Shetlands (Geological Society of London Special Publications)" by S J C Cannon and D Ellis
3. "Sediment Provenance Studies in Hydrocarbon Exploration and Production (Geological Society of London Special Publications)" by R A Scott and H R Smyth
4. "Economic Risk in Hydrocarbon Exploration " by lanLerche and John A Mac Kay

COURSE OUTCOMES:

Get the knowledge on applications of various Geo-exploration techniques.

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Third Year **SKILL BASED ELECTIVE I FIELD GEOLOGY** **Semester V**

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

To get knowledge on importance of Field Geology and usage of various gadgets in the field.

UNIT – I:

Need of field geology and role of field geologist – field equipments – places of importance for the field geologist – where to look for outcrops, fossils & other geological features. Pitting & trenching the ore bodies, Drilling- types and uses, estimation of ore reserves.

UNIT – II:

Topographic features, methods of representing topography on maps – Clinometer compass & Brunton Compass, their uses - detailed study of contouring – dip – true dip and apparent dip, their relationship – strike. Influence of dip and ground slope on outcrops.

UNIT – III:

True thickness & Vertical thickness of beds, their measurement in the field, relationships between true thickness and vertical thickness their calculation from field data. Conditions that bring about repetition of outcrops.

UNIT – IV:

Sampling – definition of a sample – sample requirement as to the size, purity contamination, packing etc. Important methods of sampling – Car samples, muck samples, channel samples, grit samples, chip samples, drill hole sampling or core sampling. Conning and quartering.

UNIT – V:

Topographic map – details, printed on the map, cardinal points (directions) conventional signs, scale of map, map references (indexing), orienting the map, locating the position of outcrops on a map, plotting attitude of beds, symbols used for rock types & various structural features – an outline of preparation of geological map and report.

UNIT VI CURRENT CONTOURS: (For continuous internal assessment only):

New trends in field survey techniques and instruments – Total Station-GPR.

REFERENCES:

1. G.W.Chiplonker, Dastane Bros: Geological Maps, Pune.
2. J.A.G.Thomas: Interpretation to Geological maps, , Murby Publishers.
3. W.B.Upton: Landforms and topographic maps, , John Wiley Publishers
4. A.Ye.Mikhaila: Structural geology and geological mapping, , Mir Publishers.
5. N.W.Gokhale: Manual of geological maps, CBS Publishers and Distributors.
6. M.P.Billings, Prentice: Structural Geology,– Hall India Ltd.

COURSE OUTCOMES:

Get the knowledge on Field Geological equipments and its utilities.

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Third Year	**CORE COURSE IX PETROLOGY**	**Semester VI**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To learn about the formation of rock due to Igneous activity and magma types, Classification of Igneous Rocks, Petrography and Petrogenesis various rocks, behaviour of major-oxide elements in rocks, Application of Harker Diagram and Triangular Diagram variation diagrams.

UNIT – I:

Igneous Petrology
Forms of Intrusive and Extrusive Igneous Rocks: Pyroclastic deposits – elaborate study of Structures and Textures of igneous rock. Classification of igneous rocks- Bases of classification- Tyrrell's tabular classification- CIPW Normative Classification

UNIT – II:

Crystallization of Unicomponent magma-Binary magmas: Diopside – Anorthite Eutectic system, Albite – Anorthite Solid-Solution system, Forsterite – Silica incongruent melting system. Bowen's reaction series. Magmatic Differentiation-Fractional Crystallization-Liquid Immiscibility- Assimilation. Petrography, petrogenesis and mode of occurrence of the following rocks: Granite- -Syenite- -Gabbro- Pegmatite- -Dunite and Anorthosite.

UNIT – III:

Sedimentary Petrology:

Sedimentary process – Weathering of rocks — Diagenesis and Lithification. A broad classification of sedimentary rocks. mechanical, chemical and organic structures. Textures of sedimentary rocks – clastic and non – clastic textures. Heavy minerals in sand and sandstones. A descriptive study of the Conglomerate-Breccia-Sandstones and Shales. Chemical deposits- Organic deposits. A brief study of Flint, Chert, Siderite, Gypsum, Rock Salt.

Metamorphic Petrology:

Definition of metamorphism –Agents and kinds of metamorphism –Regional (Dynamorthermal) metamorphism of Clayey sediments. Plutonic metamorphism - anatexis and palingenesis.

UNIT – V:

A brief study of metamorphic structures and textures. Definition of facies, zones and grades of metamorphism. Brief study and petrography of Slate, Phyllite, Quartzite, Schist. Gneiss, Charnockite, Amphibolite, and Migmatite, Mylonite, Hornfels, Marble,

UNIT VI CURRENT CONTOURS: (For continuous internal assessment only):

Identification of symbols for different rocks in Geological maps.

REFERENCES:

1. Tyrrell, G.W. (1978): The principles of petrology – Chapman and Hall Ltd., London.
2. Bowen, N.L. (1954): The Evolution of the Igneous Rocks – Dover publication, Inc, New York.
3. Barth, FW. (1962): Theoretical petrology - Wiley.
4. Walstrom, E.E. (1961): Theoretical Igneous petrology, Wiley.
5. Hatch, F.H. Wells, AK (1949): Petrology of Igneous Rocks, Thomas Murby & Wells, M.K.
6. Johannesen, A (1962): Descriptive petrography of Igneous Rocks, Vols. I to IV - Allied Publishers
7. Turner. F.J and Verhoogen.J –1960: Igneous and Metamorphic petrology – McGraw Hill.
8. Tyrrell. G.W. (1963) Principles of Petrology – Asia Publishing House.
9. Turner.F.J and Verhoogen.J (1960) - Igneous & Metamorphic petrology – McGraw Hill.
3. MacKenzie.W.S. et.al., (1982); Atlas of Igneous rocks and their textures – Longman.
10. McBirney.A.R.(1994) – Igneous Petrology – CBS Publishers and Distributors.
11. Raymond.L.A.-2002- Petrology – McGraw Hill.
12. Hall- A (1992) – Igneous Petrology – ELBS.
13. Morse.S.A – (1980) - Basalts and Phase diagrams –Springer – Verlag.
14. Winter. J.D. (2001) – Igneous and Metamorphic Petrology – Prentice Hall.
15. Winkler, H.G.F. – 1967 – Petrogenesis of Metamorphic Rocks, Springer and Verlog
16. Phillipots. R. Anthony (1994) – Principles of igneous and metamorphic petrology, Prentice-Hall of India, New Delhi
17. Sam Boggs, Jr Sam Boggs, 2009, Petrology of Sedimentary Rocks, Cambridge university press
18. Haldar, 2013, Introduction to Mineralogy and Petrology, Elsevier Science
19. Lore Raymond, 2002, Petrology The Study of Igneous, Sedimentary, and Metamorphic Rocks McGraw-Hill Education
20. GautamSen, 2013, Petrology Principles and Practice, Springer Berlin Heidelberg
21. Cornelis Klein, Anthony Philpotts, 2013, Earth Materials Introduction to Mineralogy and Petrology, Cambridge University Press
22. Anthony Philpotts, Jay Ague, 2009, Principles of Igneous and Metamorphic Petrology, Cambridge University Press
23. Ronald Frost, Carol Frost, 2019,Essentials of Igneous and Metamorphic Petrology, Cambridge University Press
24. Myron Best, 2013,Igneous and Metamorphic Petrology, Wiley
25. Bruce Yardley, 1991, An Introduction to Metamorphic Petrology ,Longman Scientific & Technical
26. John Winter, 2014,Principles of Igneous and Metamorphic Petrology, Pearson Education
27. Kurt Bucher, Martin Frey, 2013, Petrogenesis of Metamorphic Rocks,

Springer Berlin Heidelberg
28. Fans carmicheal, francis turner,1974,igneous petrology, mcgraw-hill
29. Anthony hall , 1987,igneous petrology, longman scientic and technique
30. Alexander of mc birnay , 2007,igneous petrology, jones and bartlet bearing
31. Hugnes, 2013,igneous petrology ,elseiver
32. Gupta, 2007,petrology and genesiss of igneous rock
33. Francis turner john verhogen , 2004,igneous and metamorphic petrology, cbs publication and distribution
34. Ronald frost, 2019, essengtials of igneous and metgamorphic petrology, cambridge university press
35. Anthony philtopps jagagve, 2009,Principles of igneous and metamorphic petrology, cambridge university press
36. Myronbesteric hchristansen, 2000, igneous petrology, wiley
37. Lizhaonqi zianzhon gqi zhaonhin g zhing, 1997, igneous petrology, vsp
38. Jyothishankar roy gautam sen biswajitb ghosh, 2010, topics in igneous petrology, springer
39. Verlag berlin neddellorg, 1985, principles of igneous petrology, springer

COURSE OUTCOME:

Enrichment of knowledge on different types of rocks and its formation.

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Third Year	**CORE COURSE X ECONOMIC GEOLOGY**	**Semester VI**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVE:

To study about the Materials of mineral deposits its Magmatic processes, Sedimentary and metamorphic processes of economic minerals, Fossils fuels uses, origin and distribution in India and important oil fields of India.

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 – brief study of metallogenetic epochs and provinces – geologic thermometers.

UNIT – II:

Process of mineral formation - primary and secondary process: brief outline of magmatic- sublimate-contact metasomatic- hydrothermal- metasomatic - evaporates-placer deposits - oxidation and supergene enrichment and metamorphic deposits.

UNIT – III:

Diagnostic physical properties, chemical composition, uses, modes of occurrence and distribution in India of the following economic minerals. Graphite, Barite, Gypsum, Celestite, Corundum, Ilmenite, Chromite, Magnesite, Fluorite, Phosphatic Nodule, Monazite, Asbestos, Steatite and Vermiculite. Mineralogy, mode of occurrence, uses and distribution in India of the following precious metals and minerals. Gold deposits – Gemstones. Character, distribution and mode of occurrence of structures and building materials.

UNIT – IV:

Mineralogy, mode of occurrences, uses and distribution in India of the following metalliferous deposits – Iron, Manganese, Aluminium, Copper, Lead, Zinc, Chromium. Fossils fuels:– Coal – uses, classification, constitution, origin and distribution in India. Petroleum- composition, uses, oil traps, and important oil fields of India.

UNIT – V:

Introduction to Strategic, Critical and essential minerals. National mineral policy, and their role in National economy. Mineral based Industries in India. Geology, Mode of Occurrence and Origin of the raw materials of the following Industries: Refractory- Abrasives-paint and pigments-fertilizer glass, ceramic and cement industries.

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):

Economic minerals deposits in Tamil Nadu and India.

REFERENCES:

1. Bateman Allan, (1962) M. -Economic Mineral Deposits, Asian Publishing House, 2nd Edition.
2. Lindgren, W (1933). -Mineral Deposits, MC Graw Hill,.
3. Coggin, B. and Dey, A.K. (1955) - India's Mineral Wealth, oup.
4. Park, C.F. and Macdiarmid, (1970) R.A- Ore deposits, Freeman,
5. Krishnaswamy ,S. (1979) - 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, (1978.) T.C- Ore deposits of India, their distribution and processing, Thosmson press.
8. Shackleton, 1986,economic and applied Geology, american society fer microbiology
9. Prasad, 2010,economic Geology and economicmineral deposits(2 nd edition), cbs press
10. Walter pohl , 2016,economic Geology principles and practice , wiley india exclusive
11. Sinha, 2019,mineral economic, cbs publishers
12. Asoke ghosh, 2016,mine and mineral economic, phl learing private limited
13. Prot chatterjee, 2015,introduction to mineral economics, international lid

COURSE OUTCOME:

Acquire knowledge on process and formation economic minerals, oil fields and the different extraction methods.

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Third Year **CORE PRACTICAL V** **Semester VI**

PETROLOGY AND ECONOMIC GEOLOGY

Code: **(Practical)** **Credit: 4**

COURSE OBJECTIVES:

To study above difference rock types and Ores.

Petrology:

Megascopic identification of the following rocks:

Granite, Graphic granite, Pegmatite, Schorl Rock, Granite Porphyry, Syenite, , Gabbro, Anorthosite, Dunite, Pyroxenite, Dolerite, , Basalt, Trachyte, Conglomerate, Breccia, Sandstone, Arkose, Shale, Limestone, Laterite, Peat, Lignite, Slate, Phyllite, Schists, Gneisses, Quartzite, Marble, Amphibolite, Ecologite, , Charnockite, Khondalite.

Microscopic identification and description of the following rocks:

Mica Granite, Tourmaline Granite, Schorl Rock, Aplite, Graphic Granite, 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, Garnetiferous Schist, Charnockite, Ecologite Amphibolite, Leptynite, Khondalite, Gneiss, Calc Granulite.

Economic Geology:

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

Galena, Sphalerite, Cinnabar, Pyrite, Barite, Celestite, Gypsum, Corundum, Hematite, Ilmenite, Magnetite, Chromite, Rutile, Pyrolusite, Psilomelane, Goethite, Limonite, Bauxite, Calcite, Dolomite, Magnesite, Siderite, Aragonite, Strontionite, Malachite, Fluorite, Phosphatic Nodule, Monazite, Graphite, Coal and its varieties.

CURRENT CONTOURS: (For continuous internal assessment only):

Distribution of rocks and Economic minerals deposits in Tamil Nadu and India.

REFERENCES:

1. Gautam Sen, 2013,Petrology Principles and Practice, Springer Berlin Heidelberg
2. Ron Vernon, Vernon, 2004,A Practical Guide to Rock Microstructure, Cambridge University Press
3. Robin Gill, 2011,Igneous Rocks and Processes A Practical Guide, Wiley

4. halder , 2013,Introduction to Mineralogy and Petrology, Elsevier Science
5. Anthony Philpotts, 2009,Jay Ague, Principles of Igneous and Metamorphic Petrology, Cambridge University Press
6. Ronald Frost, Carol Frost, 2019,Essentials of Igneous and Metamorphic Petrology, Cambridge University Press
7. Ronald Frost, Carol Frost, 2019,Essentials of Igneous and Metamorphic Petrology, Cambridge University Press
8. Bruce Yardley, 1991, An Introduction to Metamorphic Petrology, Longman Scientific & Technical
9. Tyrrell, 2012, The Principles of PETROLOGY An Introduction to the Science of Rocks, Springer Netherlands.
10. Cornelis Klein, Anthony Philpotts, 2013, Earth Materials Introduction to Mineralogy and Petrology, Cambridge University Press
11. Peter Scholle, Noel James, Read, 1989,Carbonate Sedimentology and Petrology, American Geophysical Union
12. Kurt Hollocher, 2014, A Pictorial Guide to Metamorphic Rocks in the Field, CRC Press
13. Myron Best, 2013 Igneous and Metamorphic Petrology, Wiley

COURSE OUTCOMES:

Get knowledge on practical applications rocks and economic minerals.

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Third Year	**MAJOR BASED ELECTIVE II** **1. HYDROGEOLOGY**	**Semester VI**
Code:	**(Theory)**	**Credit: 4**

COURSE OBJECTIVE:

To learn about the origin, occurrence and movements of groundwater in various geological formations, evaluation of aquifer parameters. Groundwater quality assessment and augmentation of groundwater storage strategy in various geological settings.

UNIT – I:

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

UNIT – II:

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

UNIT – III:

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

UNIT – IV:

Pump tests and evaluation of various aquifer parameters through pump tests – Conjunctive and consumptive use of groundwater – Sea water intrusion: causes, consequences preventive and control measures – Groundwater provinces of India – Groundwater resources of Tamil Nadu including its quality.

UNIT – V:

Groundwater 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 – Rainwater harvesting methods,

UNIT - VI CURRENT CONTOURS: (For continuous internal assessment only):

Flood inundation – ground water targeting – Rainwater harvesting.

REFERENCES:

1. Todd, D.K and L.W. Mays (2004). Groundwater Hydrology. John Wiley & Sons, 656p.
2. Davis, S.N. & Deweist., R.J.M (1966). Hydrogeology, John Wiley & Sons, New York, 463p.
3. Ragunath, H.M (2007). Groundwater, New Age International Publishers, New Delhi, 520p.
4. Karanath, K.R (1987) Groundwater Assessment, Development & Management, Tata McGraw Hill, 720p.
5. Ramakrishnan, S (1998). Groundwater. K.G. Graph Arts, Chennai, 471p.
6. Alain Dassargues, 2018, HydroGeology: Groundwater science & Engineering, CRC Press
7. Charles Fitls, 2002, Groundwater Science, Elsevier
8. Kevin Hiscock& Victor Bense, 2014, HydroGeology, Willey Blackwell science
9. Michael Kasenow, 2001 Applied Groundwater Hydrology, Water Resources Publications
10. Neven Kresic, 2006, HydroGeology& Groundwater modeling, CRC Press & Taylor and Francis group
11. Mohammad karamouz, Azadeh Ahmadi, MasihAkhbari, 2020, Groundwater Hydrology: Engineering, planning& management, CRC Press & Taylor and Francis Group
12. Felter, David kreamer , 2021, Applied HydroGeology, Waveland Press
13. Rushton, 2004, Groundwater Hydrology: conceptuals and computational models, Willey Publishers
14. Neven Kresic & zoranstevanovic, 2009, Groundwater Hydrology of springs: Engineering, Theory Management, Sustainability, Elsevier
15. Sanjay Akhauri, 2015, Fundamentals of HydroGeology, Zorba books
16. Steve Ingebristen, Ward Sanford & Chris Neuzil, 2006, Groundwater in Geologic processes, Cambridge University press
17. Bernward Golfing Wihelm G. Coldewa, 2018, HydroGeology, Springer textbooks

COURSE OUTCOMES:

Helps to find out ground water potential zones and water quality problems

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Third Year **MAJOR BASED ELECTIVE II** **Semester VI**

2. ENVIRONMENTAL GEOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

To know about the basic concepts of environmental geology, causes, effects, strategies for their mitigation.

UNIT – I:

Definition of ecology and environmental geology. Different Ecosystems. Classification of Natural resources. A short account of renewable and non-renewable resources.

UNIT – II:

Environmental problems due to exogenic processes, causes, hazards and remedial measures relating to landslides, floods and soil erosion. Impact of wind on environment and Global warming.

UNIT – III:

Influence of endogenetic processes – Earthquake hazards- Earthquake prediction control and warning; Reservoir induced seismicity -origin and impact of tsunami – hazards of volcanism- Techniques of volcanic prediction and human adjustments to volcanic environments. Benefits of volcanism.

UNIT – IV:

Man as an agent of environmental modification. Environmental degradation due to mining and mineral processing – effects of urbanization on surface water, causes of groundwater pollution.

UNIT – V:

Coastal Environment - Degradation of coastal environment and measures for coastal protection. Population explosion and their pressure on geological environments.

UNIT VI CURRENT CONTOURS (For continuous internal assessment only):

Status of Renewable and non-renewable energy resources with reference to India.

REFERENCES:

1. Keller, E.A (2010). Environmental Geology (9th Edition), Pearson Publishers, New Delhi, 624p.
2. Lundgren, L (1986). Environmental Geology, Prentice Hall Publishers, New Jersey, 528p.

3. Montgomery (2013). Environmental Geology (10th Edition), McGraw Hill Publishers, New Delhi, 576p.
4. Valdiya, K.S (2013). Environmental Geology: Ecology, Resource and Hazard Management (2nd Edition), McGraw Hill Publishers, New Delhi, 432p.
5. Erach bharuca, third edition, textbook of environmental studies, orient blackswan knodel, 2020,environmental Geology, springer
6. Ved verma, kataria & sons, 2019,environmental studies and disaster management, s.k. kataria & sons

COURSE OUTCOME:

To get knowledge on ecology and environmental geology, various resources, disasters and suitable strategies for their mitigation.

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Third Year **PROJECT** **Semester-VI**

Code: **Credit: 3**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)

   I. Plan of the Project - 20 marks

   II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc. and presentation of the report. - 45 marks

   III. Individual initiative - 15 marks

2. Viva-Voce / Internal & External - 20 marks

TOTAL **- 100 marks**

PASSING MINIMUM:

	Vivo-Voce 20 Marks	**Dissertation 80 Marks**
Project	40% out of 20 Marks (i.e. 8 Marks)	40% out of 80 marks (i.e. 32 marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

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Third Year	**SKILL BASED ELECTIVE II REMOTE SENSING**	**Semester VI**
Code:	**(Theory)**	**Credit: 2**

COURSE OBJECTIVES:

To know about the basic concepts of Remote Sensing – Satellites and its Sensor characteristics - Satellite Image interpretation and applications

UNIT – I:

Introduction to remote sensing - Basic concepts of EMR. Electro Magnetic Radiation interaction with atmosphere-scattering - absorption - atmospheric windows; EMR interaction with Earth surface features - spectral response factors with different objects-Black body radiation.

UNIT – II:

Sensors active and passive: platforms - scanning mechanism, orbiting mechanics. Resolutions - Spectral, Spatial, radiometric and temporal.

UNIT – III:

Thermal remote sensing fundamentals. Space images and data products - IRS. Landsat, SPOT and ERS

UNIT – IV:

Geostationary satellites - Space shuttle data products. Analog and digital image data product details. Image Interpretation Keys and Elements.

UNIT – V:

Spectral behavior of different soils. Mapping of soil - eroded and non eroded soil and degraded lands. Land use / Land cover interpretation. Land use planning for urban and rural areas. Role of Remote sensing in mineral exploration - Geodynamic applications.

UNIT VI CURRENT CONTOURS: (For continuous internal assessment only):

Aerial remote sensing, Hyperspectral remote sensing and Digital Image Processing and GIS

REFERENCES:

1. Lillesand, T.M and R.W. Kiefer (2000). Remote sensing and image interpretation. John Wiley & Sons, New York
2. Sabins, F.F (1987). Remote sensing principles and interpretation. Freeman Publishers, New York
3. Miller, V.C (1961). Photogeology. McGraw-Hill Publishers, New York

4. Siegal, B.S and R. Gillespie (1980). Remote sensing in Geology, John Wiley & Sons, New York
5. Curran, P (1988). Principles of remote sensing. Corgman Publishers, London
6. Pandey, S.N (1987). Principles and applications of photogeology. Wiley Eastern Ltd., New Delhi
7. Lillesand, T.M and R.W. Kiefer (2000). Remote Sensing & Image Interpretation. J. Wiley & Sons, New York, 750p.
8. Sabins, F.F (1987). Remote Sensing: Principles and Interpretation. W.H. Freeman & Co., New York, 449p.
9. Pandey, S.N (1987). Principles and Applications of Photogeology. Wiley Eastern Ltd., New Delhi, 140p.
10. Anji Reddy, M (2001). Textbook of Remote Sensing and GIS, BSP PS Publications, New Delhi, 246p.

COURSE OUTCOMES:

Get knowledge on different satellites and applications of remote sensing in assessing the earth's resources.

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