ANNAMALAI UNIVERSITY

209 - B. Sc. GEOLOGY

Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted in Affiliated Colleges from the academic year 2022 -2023 onwards)

Course Code	Part	Study Components & Course Title	Hours /Week	Credit	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – I					
22UTAML11	I	Language Course - I : Tamil/Other Languages	5	3	25	75	100
22UENGL12	II	English Course - I : Communicative English I	5	3	25	75	100
22UGEOC13	III	Core Course - I : Physical and Dynamic Geology	4	4	25	75	100
22UGEOC14		Core Course - II : Palaeontology	4	4	25	75	100
22UGEOP15		Core Practical – I : Palaeontology	3	-	-	-	-
22UCHEA01		Allied - I : Paper 1: Chemistry-I	4	4	25	75	100
		Allied Practical – I : Chemistry	3	-	-	-	-
22UENVS18	IV	Environmental Studies	2	2	25	75	100
		Total	**30**	**20**			**600**
		SEMESTER – II					
22UTAML21	I	Language Course - II : Tamil/Other Languages	5	3	25	75	100
22UENGL22	II	English Course - II : Communicative English II	5	3	25	75	100
22UGEOC23	III	Core Course – III : Structural Geology	4	4	25	75	100
22UGEOP24		Core Practical – I : Paleontology and Structural Geology	3	4	40	60	100
22UCHEA02		Allied – I : Paper 2: Chemistry-II	3	4	25	75	100
22UCHEP02		Allied Practical – I : Chemistry	3	3	40	60	100
22UGEOE27		Internal Elective – I :	3	3	25	75	100
22UVALE27	IV	Value Education	2	1	25	75	100
22USOFS28		Soft Skill	2	1	25	75	100
		Total	**30**	**26**			**900**

Internal Elective Courses

22UGEOE27-1	Internal Elective - I	Fundamentals of Applied Geology
22UGEOE27-2		Physics and Chemistry of Earth
22UGEOE27-3		Natural Resources

SEMESTER - I CORE – I PART - III	22UGEOC13: PHYSICAL AND DYNAMIC GEOLOGY	CREDITS: 4 HOURS: 4 / WEEK

COURSE OBJECTIVES

1. To know about the basic principles of Geology, the Composition of the earth, and the age of the Earth.
2. To know Earth's various exodynamic processes like weathering and action of geological agents.
3. To identify the various geological landforms produced by water.
4. To ascertain the landforms produced by exodynamic processes.
5. To know the volcanic landforms, elements of earthquakes, and tsunami.

Unit 1

Geology, scope and importance. The branches of geology and related sciences. Geological time scale. Solar system – Inner and Outer planets. Earth as a member of the solar system and its relation to other planets – Size and Density of the Earth. Earth's components. Origin of the Earth – Nebular, Planetesimal, Tidal, and Dust cloud hypotheses; their merits and demerits. Age of the Earth – Absolute, and Relative method. Interior of the earth.

Unit 2

Weathering - Introduction, Agents of weathering - Process of weathering: Physical, Chemical, and Biotic weathering. Mixed processes: Spheroidal weathering, exfoliation, and differential weathering. Mass wasting - Introduction - classification. Wind as a geological agents - Erosional methods and Erosional features, Transportation and depositional features by the wind.

Unit 3

Geological work and landforms are produced by Rivers: Introduction - Erosional process and Erosional features - Transportation - Depositional features. Types of streams and drainage patterns. The drainage basin. Groundwater: Introduction - Origin, distribution, and movement of groundwater. Types of water-bearing formations and types of aquifers. Erosional features - Transportation – Deposition.

Unit 4

Geological work and landforms are produced by Oceans: Introduction – Origin and composition of seawater – source of salt. Movements of seawater – tides, currents – waves. Erosional process and Erosional features - Transportation - Depositional features. Coral reefs and their types. Glaciers: Development and types of glaciers. Erosional processes and Erosional features - Transportation – Depositional features.

Unit 5

Volcanoes - Classification of volcanoes - Products of volcanoes and volcanic landforms. Earthquakes - Definition - causes - classification. Elements of earthquakes. Seismic waves: definition and classification. Seismograph and seismogram. Scales of earthquakes. Effects of earthquakes. Tsunami – causes and effects.

COURSE OUTCOMES

1. Students gain knowledge of geosciences and their scope and know about the Earth.
2. The students will gain knowledge about the exogenic processes that occur in the Earth's Crust and know about their agents.
3. Ability to understand different landforms produced by water.
4. Complete knowledge about the landforms produced by ocean and glaciers.
5. Ability to know the endogenic process of volcanoes and earthquakes.

Text books

1. Arthur Holmes, (1992) Principles of Physical Geology, Edited by Duff. P. 4 th Ed. Chapman and Hall, London.
2. Radhakrishnan, V. (1996) General Geology V.V.P Publishers, Tuticorin.
3. Charles C. Plummer, Diane H. Carlson and Lisa Hammersley (2016) Physical Geology, 15th edition, McGraw Hill Education, New York.
4. Miller, (1949) An Introduction to Physical Geology, East-West Press Ltd.,
5. Spencer, E.V (1962), Basic concepts of physical Geology, Oxford & IBH,
6. Charles Fletcher (2014) Physical Geology: The sciences of Earth, 2nded. Willey.
7. Mohapatra, G.B. (2014) Text book of Geology. CBS edn.

Supplementary Reading

1. Don Leet, and Sheldon Judson, (1960) Physical Geology, Prentice Hall & Co.,
2. Gorshkov,G, G and A.Yakushova,A (1967). Physical Geology, Mir Publishers, Moscow.
3. Wyllie, P.J (1971) The Dynamic Earth, John Wiley and Sons.
4. Vincent S. Cronin and Dennis Tasa (2018) Physical Geology. Pearson Publishers, New York. 15th edition.
5. Jain Sreepat (2014) Fundamentals of Physical Geology. Springer Nature India Pvt. Ltd. New Delhi

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	3	2
CO2	1	3	2	2	3
CO3	3	2	1	1	1
CO4	2	1	3	1	3
CO5	3	2	1	3	2

SEMESTER - I CORE – II PART - III	22UGEOC14: PALAEONTOLOGY	CREDITS: 4 HOURS: 4 / WEEK

COURSE OBJECTIVES

1. To acquire skills on identification, classification and documentation of remains of plants and animals.
2. To know about the organic evolution concepts.
3. Acquire knowledge on morphology, classification and geological distribution of invertebrate fossils.
4. To impart knowledge on separation and classification of different microfossils.
5. Understanding the fossil records with reference to stratigraphic sequences.

Unit 1

Palaeontology: definition, subdivisions and scope, its relationship with other sub-disciplines of geology; History of development in paleontology – Application of palaeontology in geological studies – Organic evolution: modern and ancient concepts.

Unit 2

Fossils: definition, characters and kinds (body and trace fossils) - Classification of fossils – Conditions of fossilization – Nature and importance of fossil record – Fossilization processes, modes of preservation and uses of fossils - Index Fossils.

Unit 3

Detailed study of morphology, classification and geological distribution of Molluscs (Lamellibranches, Gastropods and Cephalopods) - Detailed study of morphology, classification and geological distribution of Corals, Brachiopoda, Trilobites, Echinoderms and Graptolites.

Unit 4

Modes of preservation and broad characteristics of plant fossils - Elementary knowledge of Gondwana flora - Elementary ideas about vertebrate classes; Siwalik vertebrate fauna.

Unit 5

Micropalaeontology: Detailed study of micro fossils such as Foraminifera, Radiolaria, Ostracoda and Diatoms - General characters, classification and evolution of Horse, and Man.

COURSE OUTCOMES

1. The student will gain knowledge about the classification of animal kingdom and their distribution importance.
2. The study of Paleontology encompasses the aspects of the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time.
3. Students will able to understand animal life in the past of different phyllum their distribution.
4. The knowledge of paleontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations.
5. Able to understand the importance of plants preservation as fossils.

Text Books

1. Black, R.M. (1988): The Elements of Palaeontology, Cambridge Univ.
2. Clarkson, E.N.K. (1986): Invertebrate Palaeontology and Evolution, Allen and Un Publ.
3. Jain, P.C. and Anantharaman, M.S. (1983): Palaeontology: Evolution and Animal Distribution, Vishal Publ.
4. Lehmann, U. (1983): Fossils Invertebrate, Cambridge Univ. Press.
5. Moore, R.C., Lalicker, C.G. and Fischer, A.G.(1997): Invertebrate Fossils, CBS Publ.13
6. Nield, E.W. and Tucker, V.C.T. (1985): Palaeontology: An Introduction, Pergmon Press.
7. Prothero, D.R. (2004): Bringing Fossil to Life – An Introduction to Paleontology (2nd Ed.), McGraw Hill.

Supplementary Readings

1. Rastogi (1988): Organic Evolution, Kedarnath and Ramnath Publ.
2. Raup, D.M. and Stanley, S.M. (1985): Principles of Palaeontology, CBS Publ.
3. Shrock, R.R. and Twenhoffel,W.H. (1952): Principles of Invertebrate Paleontology, CBS Publ.
4. Stebbins (1979): Process of Organic Evolution (3rd Ed.) Prentice Hall.
5. Woods, H. (1985): Palaeontology Invertebrate, CBS Publ.
6. Bignot, G. (1985): Elements of Micropaleontoogy; Graham and Trotman Ltd., London.
7. P.K. Saraswati and M.S. Srinivasan (2016): Micropaleontology: Principles and Applications, Springer.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**1**	**3**	**2**	**1**
CO2	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**2**
CO4	**2**	**3**	**2**	**2**	**3**
CO5	**2**	**1**	**1**	**3**	**2**

SEMESTER - II CORE – III PART - III	22UGEOC23: STRUCTURAL GEOLOGY	CREDITS: 4 HOURS: 4 / WEEK

COURSE OBJECTIVES

1. To learn about the methods of representing physiographic features, and attitudes of Beds.
2. Explain the mechanical properties of rocks and their structures.
3. Descriptive study of folds, unconformities, and their classification.
4. Describe the types of faults and joints.
5. Determine the orientation of foliations and lineation and uses of compass and GPS.

Unit 1

Scope and aim of structural geology. Methods of representing physiographic features – Contour - Topographic maps and Geological maps, their preparation and uses. Beds and their attitude – strike and dip–trends of outcrops and rule of 'V'- Relation between true and apparent dips – width of outcrops – true and vertical thickness.

Unit 2

Deformation of rocks: Causes of deformation. Stress: compressive stress, tensile stress, and shearing stress. Strain - stages of rock deformation - elastic, ductile, and brittle deformation. Primary and secondary structures: Primary structures of extrusive and intrusive igneous rocks – Primary structures of sedimentary rocks: Bedding – graded beds – cross-bedding – ripple marks – mud cracks.

Unit 3

Folds*:* Geometry and elements of folded surface–classification–descriptive study of different types of folds–recognition off old sin the field and on map. Unconformities**:** definition–types–significance–criteria for recognition in the field and on a map–overlap and offlap; inlier and outlier.

Unit 4

Faults: definition – terminology – genetic and geometric classification and description of faults – 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 and descriptive study – applications of joints.

Unit 5

Foliation: Primary and secondary foliations; Cleavage and Schistosity: Types and Origin of Rock Cleavages. *Lineation*: Types and origin of lineation. Mechanism and uses of Clinometer and Brunton compass. GPS and its uses in geological mapping.

COURSE OUTCOMES

1. Students will gain the basic knowledge of various physiographic features and understand the geometry of geological structures.
2. Understand the mechanical deformation of rocks and its various structures.
3. Ability to know the geometry, and elements of folds and unconformity and recognition in the field.
4. Complete understanding the genetic and geometric classification of faults and joints.
5. Gain the knowledge of origin and types of foliations and lineations and mechanism of mapping.

Text Books

1. Billings, M.P. (1972) Structural geology 3 ed. Prentice Hall, Inc. Englewood Clifs, N.J.
2. Davis, G.R. 1984, Structural Geology of Rocks and Region, John Wiley
3. Hills, E.S. Elements of Structural Geology, 2nd ed. Wiley, New York.
4. Hobbs, B.E., Means, W.D. Williams, P.F. 1976. An Outline of Structural geology, John Wiley.
5. Lahee F H (2002) Field Geology 6th ed. Mc Graw Hill Book Company Inc. New York
6. Robert R Compton, 1962, Manual of field geology, John Wiley and sons.

Supplementary Readings

1. Bruce E. Hobbs, Winthrop.D.Means, Paul F.Williams - An outlines of structural geology –
2. John Wiley and Son, New York.
3. Himus and Sweeting – The elements of Filed Geology – University Tutorial Press Ltd. -
4. London.
5. Gokhale. N.W (2014) Theory of structural geology.CBS ed.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2
CO2	2	1	3	1	2
CO3	1	2	1	2	3
CO4	3	2	1	1	3
CO5	3	3	3	2	2

SEMESTER - II CORE PRACTICAL – I PART - III	22UGEOP24: PALAEONTOLOGY AND STRUCTURAL GEOLOGY	CREDITS: 4 HOURS: 3 / WEEK

COURSE OBJECTIVES

1. Knowledge of various modes of preservation of fossils.
2. To acquire knowledge in the identification of fossils both in field and laboratory and study of various fossils in terms of their classification, morphological characteristics and geological distribution of fossils.
3. To familiarize in the identification of important fossil, ecology and their significance to the geological environment.
4. They will be trained for the field measurement techniques like true dip, apparent dip, andestimation on the thickness of bed.
5. Able to prepare geological structural maps.

Practical/Exercise

Paleontology

1. Study of fossils showing various modes of preservation.
2. Drawing and description of invertebrate and plant fossils as per the list mentioned in the theory syllabus.
3. Classification, morphology and geological distribution of following Fossils: Cidaris, Micraster, Hemiaster. Cerethium, Terebratula, Spirifer, Rhynchonella, Products, Turritella, Natica, Physa, Pecten, Gryphaea, Arca, Cardita, Nautilus, Ammonodis,Ceratites, Bellemnites, Calymene, Paradoxide. Corals - Plant fossils: Glossopeteris,Gangamopteris and Ptylophyllum.

Structural Geology

1. Calculation of True dip and apparent dip.
2. Determination of Throw/Heave/ Stratigraphic separation
3. Estimation of Thickness of beds,
4. Methods of representing physiographic features on geological and contour maps
5. Interpretation of geological and contour maps.

COURSE OUTCOMES

1. Students get knowledge about the modes of preservation of fossils and application of palaeontology in stratigraphic time-scale.
2. Detailed knowledge about the morphological characters of various kinds of fossils and their distribution over the world.
3. The students will have practical experience on the measurement of Geometry of geological formation
4. Students will easily understand the mapping of the geological features.
5. Capable of doing geological surveys.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**3**	**2**
CO2	**2**	**3**	**1**	**3**	**2**
CO3	**3**	**3**	**3**	**2**	**3**
CO4	**1**	**2**	**1**	**1**	**2**
CO5	**2**	**1**	**2**	**2**	**3**

SEMESTER - II INTERNAL ELECTIVE– I PART - III	22UGEOE27 - 1: FUNDAMENTALS OF APPLIED GEOLOGY	CREDITS: 3 HOURS: 3 / WEEK

COURSE OBJECTIVES

1. To understand the applied geology subjects and their importance.
2. To know the relationship between geology and other branches.
3. Capable of connecting applied geology to other fields.
4. To know about the role of physics and chemistry plays in geology.
5. To understand the role of geologists in other fields.

Unit 1

Geology and applied geology- Scope and importance of applied geology- Relation with their branches of sciences.

Unit 2

Applied hydrogeology - concept- scope and importance- relation with other branches of hydrogeology.

Unit 3

Applied sedimentology- definition- scope and importance- relation with other branches of petrology, environment and stratigraphy.

Unit 4

Geophysics- definition- scope and application, Geochemistry- definition- scope and applications. Relationship with other branches.

Unit 5

Engineering geology- application with engineering projects. Mining geology, Environmental geology- concept, scope and role of geologists.

COURSE OUTCOMES

1. Students able to understand the basis of the subject
2. Understand the different branches of applied geology.
3. Understand the relationship and importance of studying applied geology
4. Able to utilize their professional expertise in the field of applied geology.
5. Students will understand the other fields applied in geology.

Text Books

1. Sanjay Akhauri, 2015, Fundamentals of Hydrogeology, Zobra Books.
2. Bernard K Rop, Wycliffe H Namwiba, 2018 Fundamentals of Applied Geology Competency and Evaluation Approach, LAP LAMBERT Acdemic Publishing, Germany.
3. D.V. Reddy, 2018 Applied Geology, I Edn.Vikas Publishing House Pvt. Ltd.
4. G.B.Mahapatra, 2017. A text book of Geology, New Age International (P) Ltd. Publishers India.

Supplementary readings

1. P.K.Mukherejee, 1987 A text book of Geology, Kolkata.
2. Suboth Dhakal, 2012 Fundamentals of Geology, Kalyani Subedi, Nepal.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	3	2
CO2	2	1	3	1	2
CO3	1	2	1	2	3
CO4	3	1	2	1	3
CO5	1	3	3	2	2

SEMESTER - II INTERNAL ELECTIVE – I PART - III	22UGEOE27 - 2: PHYSICS AND CHEMISTRY OF EARTH	CREDITS: 3 HOURS: 3 / WEEK

COURSE OBJECTIVES

1. To understand the earth and its importance.
2. To know the origin and distribution of elements.
3. Knowledge of the fundamentals of chemistry, and physics needed to provide insight into the earth processes.
4. To know about the elements of earth and solar system.
5. Able to know the environmental degradation due to geological waste.

Unit 1

Earth: surface features Continents, continental margins, oceans.

Unit 2

Earth's interior Variation of physical quantities and seismic wave velocity inside the earth, major sub divisions and discontinuities. Concepts of Isostasy; Airy and Pratt Model. Core: Seismological and other geophysical constraints. The geodynamo – convection in the mantle.

Unit 3

Elements of earth's magnetism Secular variation and westward drift; Solar activity and magnetic disturbance.

Unit 4

Elements – origin, abundance in the solar system / planet earth; Earth accretion and early differentiation; Stable isotopes: Different isotopes and its geological applications.

Unit 5

Environmental geochemistry Geological disposal of nuclear waste; Lead in environment and effect of lead on human health

COURSE OUTCOMES

1. Students able to understand the basis of the subject
2. Understand the different physical characteristics of the earth.
3. Understand the different chemical components of the earth.
4. Students can understand the stable and radioactive isotopes to geological processes and time scales.
5. Understand the environmental geochemistry.

Text Books

1. Holmes, A., Principles of Physical Geology, 1992, Chapman and Hall
2. Condie, K.C. Plate Tectonics and Crustal Evolution, Pargamon Press, 1989.
3. Krauskopf, K. B., & Dennis, K. Bird, 1995, Introduction to Geochemistry. McGraw-Hill

Supplementary Readings

1. Faure, G. Principles and Applications of Geochemistry(1998), Prentice Hall, 600 pp.
2. Anderson, G. M. (1996). Thermodynamics of natural systems. John Wiley & Sons Inc.
3. Steiner, E. (2008). The chemistry Maths book. Oxford University Press.
4. Yates, P. (2007) Chemical calculations. 2nd Ed. CRC Press.

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	1	2	2	3	2
CO2	2	1	3	1	2
CO3	1	3	1	3	2
CO4	2	1	2	1	3
CO5	2	3	3	2	2

SEMESTER - II INTERNAL ELECTIVE – I PART - III	22UGEOE27 - 3: NATURAL RESOURCES	CREDITS: 3 HOURS: 3 / WEEK

COURSE OBJECTIVES

1. To understand the sources on the earth.
2. To know the forest and water resources and their types and process.
3. To know the atomic and metallic minerals.
4. To know the knowledge about food and energy resources.
5. To know about the importance of studying natural resources.

Unit 1

Forest resources - types of forest- uses of forests.

Unit 2

Water Resources- Surface water- Ground water ad wells- floods- water pollution and quality- water-borne diseases.

Unit 3

Mineral resources- a brief outline of metallic minerals- atomic minerals.

Unit 4

Food resources- world food problem- uneven distribution of food- changes caused by agriculture- Fertilizers- Pesticides.

Unit 5

Energy resources- energy demands- renewable energy resources- non renewable energy resources- atomic energy.

COURSE OUTCOMES

1. Gain knowledge of natural resources on the earth.
2. Gain the knowledge of distribution and management of resources.
3. Students will understand the basics concepts, compounds and problems particularly as related to the environment, water, plants and food crops.
4. Students will understand Mineral and Energy resources and their role in society.
5. Students will have a greater knowledge of how natural resources relate to the economy and environment, both current and future.

Text Books

1. Anji Reddy. M (2012) Text of Environmental Sciences, B.S.Publications, Hyderabad.
2. Daniel R. Lynch (2009).Sustainable Natural resource Management; for Scientists and Engineers. Cambridge University Press.
3. Kevin H. Deal. (2011) Wildlife and natural Resource Management, 3rd edition. Delmar Cengage.

Supplementary readings

1. Graham Park (2016). Introducing Natural Resources, Dunedin Academic.
2. Pandey.B.W. (2005). Natural Resource Management. Mittal Publications

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	1	2	2	3	2
CO2	2	1	3	2	2
CO3	1	3	1	3	2
CO4	2	2	2	1	3
CO5	3	2	3	2	2