

ANDHRA KESARI UNIVERSITY

Programme: B.Sc. Honours in Geology (Major)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	3+2	4
	I	2	Advances in Mathematical, Physical and Chemical Sciences	3+2	4
	II	3	Geology and Branches of Geology	3	3
			Geology and Branches of Geology Practical Course	2	1
	II	4	Physical Geology and Soil Science	3	3
			Physical Geology and Soil Science Practical Course	2	1
II	III	5	Crystallography & Mineralogy	3	3
			Crystallography & Mineralogy Practical Course	2	1
		6	Palaeontology	3	3
			Palaeontology Practical Course	2	1
		7	Fossil Fuels	3	3
			Fossil Fuels Practical Course	2	1
	8	Field Geology	3	3	
		Field Geology Practical Course	2	1	
	IV	9	Elements of Petrology	3	3
			Elements of Petrology Practical Course	2	1
		10	Igneous, Metamorphic & Sedimentary Petrology	3	3
			Igneous, Metamorphic & Sedimentary Petrology Practical Course	2	1
		11	Structural Geology	3	3
			Structural Geology Practical Course	2	1

SEMESTER-III
COURSE 5: CRYSTALLOGRAPHY & MINERALOGY

Theory

Credits: 4

5 hrs/week

Programme Objectives:

To study crystal systems, 32 crystal classes and their consecutive minerals. To study the Physical and chemical and optical properties of minerals for their identification. It is an optional under Minor Subject.

Programme outcomes:

After completion of the paper, students will be acquainted with the knowledge of identification of Minerals through their physical, chemical and optical properties and the crystal system which they have developed during their origin.

Unit 1

Elements of Crystallography – Derivation of 32 Crystal classes and Herman-Maughn Symbols, twin laws and twin crystals, X-ray crystallography and irregularities in crystals, Etch figures.

15 hours

Unit 2

Structures of silicates, isomorphism and polymorphism. Physical, chemical and optical properties, mode of occurrence of the following mineral groups: Quartz, Feldspars, Feldspathoids and Zeolites.

15 hours

Unit 3

Physical, chemical and optical characters and mode of occurrence of the following mineral groups -- olivine, pyroxene, amphibole, mica, Garnet and Aluminum silicates.

15 hours

Unit 4

Nature of light rays and their propagation, internal reflection, double refraction, interference and polarization. Nicol Prism and polaroids. Petrological microscope - parts and their functions. Preparation of thin section of minerals and rocks.

15 hours

Unit 5

Snell's Law – Critical angle – Total Reflection, Pleochroism, Extinction, Determination of retardation with Berek compensator, optic axial angle, Uniaxial and biaxial minerals, Gypsum plate, Quartz wedge and mica plate

15 hours

Reference Books

1. A Text Book of Mineralogy by E.S.Dana
2. Elements of Crystallography by F.A.Wade and R.B.Matrox.
3. Elements of Mineralogy by Rutleys
4. Optical mineralogy by Paul F.F. Kerr
5. Mineral Optics by Philips W.R.
6. Elements of Optical Mineralogy by Winchell A.N.

SEMESTER-III
COURSE 6: PALAEOONTOLOGY

Credits: 4

Theory

5Hrs/Week

Programme Objectives:

To inculcate knowledge of fossils, process of fossilization, their identification and uses.

Programme Outcomes:

Students will get a complete knowledge about fossils, fossilization process, types, distribution and uses of fossils

Unit 1

Fossilization and fossil record - Nature and importance of fossil record; Fossilization processes - and modes of preservation - Species concept with special reference to paleontology, Taxonomic hierarchy Theory of organic evolution interpreted from fossil record. 15 hours

Unit 2

Brief introduction to important invertebrate groups (Bivalvia, Gastropoda, Brachiopoda) and their biostratigraphic significance Significance of ammonites in Mesozoic biostratigraphy and their paleobiogeographic implications. Functional adaptation in trilobites and ammonoids. 15 hours

Unit 3

Origin of vertebrates and major steps in vertebrate evolution. Mesozoic reptiles with special reference to origin diversity and extinction of dinosaurs. Evolution of horse and intercontinental migrations. Human evolution. 15 hours

Unit 4

Scope of paleobotany, taxonomy of plants, Gondwana flora and their significance. Separation of spores and pollens and mounting for study. Utility of palynological studies in different fields. 15 hours

Unit 5

Application of fossils in Stratigraphy - Biozones, index fossils, correlation - Role of fossils in sequence stratigraphy - Fossils and paleoenvironmental analysis - Fossils and paleobiogeography, biogeographic provinces, dispersals and barriers - Paleoecology – fossils as a window to the evolution of ecosystems. 15 hours

Suggested readings

1. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology
2. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.
3. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
4. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher
5. Armstrong, H. A., & Brasier, M.D. (2005) Microfossils. Blackwell Publishing

SEMSTER-III
COURSE 7: FOSSIL FUELS

Theory

Credits: 4

5 hrs/week

Programme objectives:

The paper defines the fossil fuels, types of fossil fuels, physical and chemical properties of fossil fuels, host rocks, host rock properties, advantages and disadvantages of extraction, utilization of fossil fuels to the man kind and environmental impacts.

Programme outcomes:

Student will get a complete knowledge about fossil fuels, their origin, occurrence, physical and chemical composition, advantages and disadvantages, host rock properties, and distribution of fossil fuels.

Unit 1

Introduction – History, Definition, Importance, types of fossil fuels – Types of Fossil Fuels – Coal, Crude Oil, Natural Gas – Advantages and Disadvantages – Types of Host rocks – Host rock properties. 15 hours

Unit 2

Petroleum – Origin- inorganic and organic theories – migration and accumulation of oil, Composition of Oil – Geological age of reservoir rocks – Classification of traps. Petroliferous basins of India. Geology of the productive oil fields of India. Status of Oil and Natural Gas in India- Gas Hydrates. 15 hours

Unit 3

Coal – Origin and classification – Chemical characterization – Proximate and ultimate analysis – Geological and Geographical distribution of coal deposits in India. Detailed Geology for important coal fields of India. 15 hours

Unit 4

Natural Gas – Origin – biogenic and thermogenic theories – chemical characterization – Reservoir rocks – Process of formation of natural gas - Types of natural gas based on host rock –shale gas, Tight gas, Coal Seam gas – Composition of Natural Gas – Important occurrences in India. 15 hours

Unit 5

Oil & Natural Gas Exploration Techniques – Surveying and Mapping, Determination of Formation, Drilling, Logging – Role of Seismology – Onshore Seismology, Offshore Seismology – Role of Microfossils – Exploratory wells and Logging – Brief idea of Extraction methods of Oil, Natural gas and Coal. 15 hours

Suggested Readings

1. Fossil fuel". ScienceDaily. Retrieved 29 October 2021.
2. Fossil fuels". Geological Survey Ireland. Retrieved 29 October 2021.
3. Jump up to:^a ^b "thermochemistry of fossil fuel formation" (PDF). Archived (PDF) from the original on 20 September 2015.

4. Paul Mann, Lisa Gahagan, and Mark B. Gordon, "Tectonic setting of the world's giant oil and gas fields", in Michel T. Halbouty (ed.) *Giant Oil and Gas Fields of the Decade, 1990–1999*, Tulsa, Okla.: American Association of Petroleum Geologists, p. 50, accessed 22 June 2009.
5. Ritchie, Hannah; Roser, Max (28 November 2020). "Energy". *Our World in Data*.

SEMESTER-III
COURSE 8: FIELD GEOLOGY

Theory

Credits: 4

5Hrs/Week

Programme objectives:

Geology in general is a kind of subject, which has an equal part of study in the field on par with the class room learning. The paper Field Geology is designed to provide complete knowledge of field study starting from the equipment required in the field, up to the criteria of mapping various features in the field.

Programme outcomes:

Student will get a complete real time knowledge what he learned in the class room. He will get an idea about the field equipment, technique of sampling, locating himself in the field, use of Toposect in the field, Field mapping etc.

Unit 1

Introduction – Importance of Field Geology – Basic Field equipment – Compass & Clinometer – principle and uses, Magnetic declination, Bearing and reading directions, measuring attitude, Finding directions without compass. 15 hours

Unit 2

Topographic Maps – Survey of India Maps, Scale of Maps, Numbering the Toposheets – Conventional, Advanced numbering - Depiction of Relief – Latitudes and Longitudes – Map Grids – Measurement of Mapped areas – Mounting and Folding of Field Maps – Marking on Maps. 15 hours

Unit 3

Field guides - Preliminary observations – Status of the area, Topography of the terrain – Regional Geology – Structures of the terrain – Strike & Dip – Contacts & Boundaries – Correlation – Geological Cross sections – Marking the map. 15 hours

Unit 4

Specimens and Samples – Significance – Trimming of hand specimens – Fossil Specimens, Mineral Specimens – Samples and Sampling – Numbering and labeling of specimens, Packing and storage of samples – Field identification of Rocks – Basic Field Observation, Documentation 15 hours

Unit 5

Basic Field Procedures – Location – Outcrops, Soil colour, rock type – Measuring distances – Compass and Tape Traversing – Determination of Slopes and Gradients – Measuring Difference in Elevation – Triangulation Method — Field Sketches and Drawings – Field Photographs. 15 hours

Suggested Readings

Field Geology – F.H.Lahee
Guide to Field Geology – S.M.Mathur

SEMESTER-IV
COURSE 9: ELEMENTS OF PETROLOGY

Theory

Credits: 4

5Hrs/Week

Programme objectives:

The paper is designed to provide a brief knowledge about petrology and its three divisions viz., Igneous Petrology, Sedimentary Petrology and Metamorphic Petrology and description of rocks belonging to each branch. It is an optional under Minor Subject.

Programme outcomes:

Student will get a brief knowledge about

Unit 1

Introduction – Scope of Study of rocks – Composition and Constitution of Magma - Differentiation, Assimilation – Rock Definition - Rock Cycle – Process of formation of Rocks – Brief outline of Bowens Reaction principle. 15 hours

Unit 2

Igneous Rocks – General Characters, Main Igneous rock groups, composition, colour, texture, grain size and crystallinity – Flows – Dykes and Sills – Pipes – Pegmatites – Pyroclastic rocks. 15 hours

Unit 3

Metamorphic Rocks – Definition – Conditions for the formation of Metamorphic rocks – Main Metamorphic rock groups – cleavage, texture, foliation, lineation – Metamorphic folding, grain size – Definition of Metamorphic Facies. 15 hours

Unit 4

Sedimentary Rocks – Definition – Processes of Formation – Classification – Bedding – Particle size – Sorting – Shape of the particles – Matrix and Cement – Sedimentary structures – Sedimentary Facies – Cyclic Sedimentation – Rudaceous Rocks – Arenites, Argillites, Lutites, Turbidites, Calcareous rocks, Organic deposits. 15 hours

Unit 5

Physical Properties of Igneous rocks - Granites, granodiorites, gabbro, phorphories, Dolerites, Rhyolites, Basalts – Metamorphic Rocks - Schist, Gneiss, Amphibolite, Quartzite, Marble, Slate, Phyllite – Sedimentary Rocks - Breccia, Conglomerate, Lime Stone, Sand Stone, Shale, Silt, Shell Lime Stone. 15 hours

Suggested Readings

1. Igneous and Metamorphic Petrology – Turner and Verhoogen
2. Petrology of Igneous and Metamorphic rocks – Hyndman
3. The petrography of Igneous and Metamorphic rocks in India – S.C.Chatterjee.
4. Metamorphic petrology- B. Bhaskara Rao
5. Sedimentary Rocks – Pettijohn, F.J.
6. Origin of Sedimentary Rocks – Blottt, H., Middleton, G. and Murray, R.
7. Introduction to Sedimentology – Sengupta, S.M.
8. An Introduction to Sedimentology – Shelly, R.C.

SEMESTER-IV

COURSE 10: IGNEOUS, SEDIMENTARY AND METAMORPHIC PETROLOGY

Theory

Credits:4

5Hrs/Week

Programme objectives:

To give a complete knowledge on Igneous, Sedimentary and Metamorphic rocks. To provide information on classification, textures, structures, origin, forms of Igneous, Sedimentary and Metamorphic Rocks.

Programme outcomes:

Student will get a complete knowledge on origin, classification, textures, structures, forms of Igneous, Sedimentary and Metamorphic rocks and their physical, chemical characteristics.

Unit 1

Introduction to Igneous Petrology – Formation of igneous rocks – Crystallization of unicomponent, Bicomponent and ternary magmas. Origin, composition and constitution of magmas. 15 hours

Unit 2

Bowen's reaction principle – Magmatic Differentiation – Fractional crystallization and assimilation - Forms, structures and textures of igneous rocks. Classification of Igneous rocks. 15 hours

Unit 3

Metamorphism, metamorphic processes, Agents of metamorphism, kinds of metamorphism, classification and nomenclature of metamorphic rocks, structures and textures of metamorphic rocks - Grades and zones of metamorphism – Concept and types of metamorphic facies – ACF, AKF and AFM diagrams. 15 hours

Unit 4

Sedimentology – Origin of Sedimentary of rocks. Structures and textures of Sedimentary rocks. Provenance, lithification and diagenesis of Sedimentary rocks - Classification of sedimentary environments – Non-marine environments – Glacial, Aeolian, Lacustrine and Fluvial environments. 15 hours

Unit 5

Marine environments – Shelf and Deep sea sediments – Classification and origin of Clastic and Non-clastic rocks. Clastic – Rudaceous, Arenaceous and argillaceous rocks. Non-Clastic – Chemical and Organic deposits. 15 hours

Suggested Readings

1. Igneous and Metamorphic Petrology – Turner and Verhoogen
2. Petrology of Igneous and Metamorphic rocks – Hyndman
3. The petrography of Igneous and Metamorphic rocks in India – S.C.Chatterjee.
4. Metamorphic petrology- B. Bhaskara Rao
5. Sedimentary Rocks – Pettijohn, F.J.
6. Origin of Sedimentary Rocks – Blottt, H., Middleton, G. and Murray, R.
7. Introduction to Sedimentology – Sengupta, S.M.
8. An Introduction to Sedimentology – Shelly, R.C.

SEMESTER-IV
COURSE 11: STRUCTURAL GEOLOGY

Theory

Credits: 4

5Hrs/Week

Programme objectives:

To inculcate knowledge on principles and mechanics of structural deformation of rocks, types of structural deformations, their advantages, disadvantages. It is an optional under Minor Subject.

Programme outcomes:

Student will get a complete knowledge on principles and mechanics of structural deformations of rocks, types of deformations, their advantages and disadvantages.

Unit 1

Mechanical principles and properties of rocks and their controlling factors – Concept of stress and strain – two dimensional stress and strain analyses – Concept of Dip and Strike - Geometric classification of Folds - Mechanics of folding and buckling and recognition of folds.

15 hours

Unit 2

Joints Classification and their importance in Construction projects. Mechanics of faulting. Classification and recognition of faults. Strike slip faults, normal faults.

15 hours

Unit 3

Unconformities – types of unconformities, criteria for recognition and significance of unconformities. Lineation – problem of lineation indicating extension parallel to fold axis, small scale folds.

15 hours

Unit 4

Structural association, salt domes, diapirs, nappe, tectonic mélanges. Tectonic aspects of Igneous rocks. Geometric classification of plutonic igneous rocks, tectonic setting of plutons.

15 hours

Unit 5

Structures in metamorphic rocks, Foliation, Axial plane foliation, transported foliation, other metamorphic foliations.

15 hours

Suggested Readings

1. Structural and Tectonic principles - Badgley, P.C.
2. Mechanics in Structural geology, Bayly, B.
3. Structural geology – Billings M.P.
4. Structural geology of rocks and region – Davis G.R.
5. Understanding the Earth – Gass I.B., Peter J.Smith and Smith PGL
6. An outline of Structural geology
7. Global tectonics – Keary. P., and Vine F.J.
8. Modres. E., and Twiss., R.J.
9. Folding and fracturing of rocks : Ramsy, J.G.

ANDHRA KESARI UNIVERSITY-ONGOLE, PRAKASAM DISTRICT
Single Major Programme from the Year 2023-24 Onwards
Programme-B.Sc. Honours Geology -Question Paper model,
Second Year-Semester-III & IV

Time: 3 Hours

Total Marks: 75

PART –A

Answer any Five of the following

5X5=25 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

PART –B

Answer the following

5x10=50 Marks

- 11a.
- 11b.
- 12a.
- 12b.
- 13a.
- 13b.
- 14a.
- 14b.
- 15a.
- 15b.

Or

Or

Or

Or

Or