



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

MINOR

Subject: Geology

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	II	1	Geology and Branches of Geology	3	3
			Geology and Branches of Geology Practical Course	2	1
II	III	2	Crystallography & Mineralogy	3	3
			Crystallography & Mineralogy Practical Course	2	1
	IV	3	Elements of Petrology	3	3
			Elements of Petrology Practical Course	2	1
		4	Structural Geology	3	3
			Structural Geology Practical Course	2	1
III	V	5	Economic Geology	3	3
			Economic Geology Practical Course	2	1
		6	Indian Geology & Stratigraphy	3	3
			Indian Geology & Stratigraphy Practical Course	2	1

SEMESTER-II
COURSE 1: GEOLOGY & BRANCHES OF GEOLOGY

Theory

Credits: 3

3 hrs/week

Programme Objectives

The paper is designed to learn about the subject Geology and various branches of geology. In every unit all the branches of Geology were briefly discussed and a gist of complete geology is given. It is an optional under Minor Subject.

Programme outcomes

The paper will give a brief picture of subject Geology and its branches. The student will get a complete knowledge of what are the different branches that make the subject Geology.

Unit 1

Introduction – Scope of Geology – Physical Geology & Geomorphology – Definition, origin and age of earth, interior of earth – geomorphological cycle, weathering and erosion, geological work of wind, river, glacier, ocean, underground water – Geodynamics – Definition, continental drift, sea-floor spreading, brief idea of plate tectonics – Environmental Geology – Concept, definitions of atmosphere, hydrosphere, lithosphere, biosphere. 15 hours

Unit 2

Crystallography – Definition, Crystal parameters, symmetry elements, description of crystal classes, systems – Mineralogy – Definition and characters of mineral, chemical composition and diagnostic physical properties of minerals – Petrology – Definition, Igneous Petrology, types, origin, forms textures, structures of igneous rocks – Sedimentary rocks – origin, classification, textures, structures – Metamorphic rocks – process and products of metamorphism, factors, zones, grades, textures and structures of Metamorphic rocks. 15 hours

Unit 3

Structural Geology – Definition, Elementary idea of types of deformation, Folds, Faults, Joints, unconformity, outcrop, dip, strike – Economic geology – Definition, ore and ore deposits, gangue minerals, classification of economic minerals, brief outline of process of formation of mineral deposits – Stratigraphy & Indian Geology – Principles, Geological Time Scale, Physiographic divisions of India, out line of Precambrian successions, Dharwar, Cuddapah, Vindhyan, Dhilli Supergroups. 15 hours

Unit 4

Palaeontology – Definition, Fossils, mode of preservation, significance of fossils, definition and geological distribution of brachiopods, pelecypods, cephalopods, trilobite, echinoidea - Hydrology – Definition, Hydrological cycle, precipitation, evaporation, transpiration, infiltration, porosity, permeability, vertical distribution of groundwater, aquifers, types of aquifers. 15 hours

Unit 5

Geochemistry – Introduction, idea of periodic table, cosmic abundance of elements, Geochemical cycle, Gold Schmidt's geochemical classification of elements, major, minor and trace elements in igneous, metamorphic and sedimentary rocks, isomorphism, polymorphism – Mineral Exploration – Brief idea on geological, geochemical and geophysical prospecting –

Remote Sensing and GIS – Fundamentals of Remote Sensing, Sensors, brief idea of Digital Image processing – Introduction to GIS , components of GIS, tools for map analysis.

15 hours

Suggested Readings

Text Book of Geology – G.B.Mahapatra

Engineering and General Geology – Parbin Singh

SEMESTER-III
COURSE 2: CRYSTALLOGRAPHY & MINERALOGY

Theory

Credits: 3

3 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-IV
COURSE 3: ELEMENTS OF PETROLOGY

Theory

Credits: 3

3 hrs/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, porphyries, 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 4: STRUCTURAL GEOLOGY

Theory

Credits: 3

3 hrs/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.

SEMESTER-V
COURSE 5: ECONOMIC GEOLOGY

Theory

Credits: 3

3 hrs/week

Programme objectives

To provide knowledge on important economic minerals, their classification, origin, occurrence and distribution in Andhra Pradesh and India. Further to give information on physical and chemical properties of important economic minerals. It is an optional under Minor Subject.

Programme outcomes

Students will get full information on classification, origin, occurrence, distribution, physical and chemical properties of economic minerals.

Unit 1

Concept of ore, ore minerals and gangue in economic geology; Tenor of ores; Ore forming minerals – metallic and non-metallic; Common forms and structures of ore deposits; Paragenesis, paragenetic sequence and zoning in metallic ore deposits. 15 hours

Unit 2

Processes of formation of ore deposits; Magmatic, contact metasomatic, pegmatitic, hydrothermal, sedimentation, residual concentration, mechanical concentration, oxidation and supergene sulphide enrichment and metamorphism. 15 hours

Unit 3

Study of important industrial minerals of India with particular reference to the industries - cement, glass and ceramics, refractory, fertilizer and building stones, chemicals and gemstones. Mineral Resources of Andhra Pradesh. 15 hours

Unit 4

Chemical composition, diagnostic characters, uses and distribution in India of the following minerals: magnetite, hematite, chromite, psilomalane, pyrolusite, chalcopryrite, galena, sphalerite, native gold, magnesite, bauxite, pyrite, diamond, muscovite, beryl, fluorite, gypsum, barite, halite, phosphorite, talc, kyanite, graphite, asbestos, monazite and corundum. 15 hours

Unit 5

Processes of formation, geological occurrence, uses and distribution of coal and petroleum in India; A brief study of atomic fuels 15 hours

Suggested Readings

1. Jense, M.L., Bateman, and A.M. (1981): Economic Mineral Deposits, John Wiley and Sons.
2. Krishnaswamy, S. (1979): India's Minerals Resources, Oxford and IBH Publ.
3. Brown, C. and Dey, A.K. (1955): Indian Mineral Wealth, Oxford Univ
4. Sharma, N.L. and Ram, K.V.S. (1972): Introduction to India's Economic Minerals, Dhanbad Publ.

SEMESTER-V
COURSE 6: INDIAN GEOLOGY AND STRATIGRAPHY

Theory

Credits: 3

3 hrs/week

Programme objectives

To provide information on Indian stratigraphy and world stratigraphy, elements of stratigraphy, important sedimentary basins of India, their age, and geological time scale. It is an optional under Minor Subject

Programme outcomes

Students will get a complete knowledge on Indian stratigraphy and world stratigraphy, elements of stratigraphy, important sedimentary basins of India, their age, and geological time scale

Unit 1

Physiographic and tectonic subdivisions of India Introduction to Indian Shield Introduction to Proterozoic basins of India. Geology of Vindhyan, Pranhita-Godavari and Cudappah basins of India. Paleozoic Succession of Kashmir and its correlatives from Spiti and Zaskar Stratigraphy Structure of Gondwana basins. 15 hours

Unit 2

Mesozoic stratigraphy of India: a. Triassic successions of Spiti, b. Jurassic of Kutch, c. Cretaceous, successions of Cauvery basins Cenozoic stratigraphy of India: a. Kutch basin, b. Siwalik successions, c. Assam, Andaman and Arakan basins. Stratigraphy and structure of Krishna-Godavari basin, Cauvery basin, Bombay offshore basin, Kutch and Saurashtra basins 15 hours

Unit 3

Volcanic provinces of India a. Deccan, b. Rajmahal, c. Sylhet Trap. Important Stratigraphic boundaries in India - a. Precambrian-Cambrian boundary, b. Permian-Triassic boundary, and c. Cretaceous-Tertiary boundary 15 hours

Unit 4

Stratigraphy: Definition, its scope – Principles of stratigraphy; Geological Time Scale; Stratigraphic classification; rock units, time units and time- rock units; Physical and structural subdivisions of India and their characteristics. 15 hours

Unit 5

Stratigraphic approaches to study the Precambrian rocks of India with special reference to classification, lithology and economic significance - Dharwar of Karnataka Cuddapah of Telengana and Andhra Pradesh, Vindhyan of Son valley and Marwar Supergroup of Rajasthan. 15 hours

Suggested Readings

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
3. Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
4. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd.
5. Boggs, S. (2001): Principles of Sedimentology and Stratigraphy, Prentice Hall.
6. Krishnan, M.S. (1968): Geology of India and Burma, Higgibothon, Madras.
7. Kumar, R. (1985): Historical Geology and Stratigraphy of India, Wiley Eastern Ltd.
8. Wadia, D.N. (1966): Geology of India, English language Publ.