DEPARTMENT OF GEOLOGY
DETAILED SYLLABUS

SEMESTER-II

R 23	Course-3	L	P	T	C
	GEOLOGY & BRANCHES OF GEOLOGY **Course code : 3**	3	1	--	4
Total Contact Hours – 48					

- **Course 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.
- **Learning Outcomes:**
  - At the end of the course, the learners should be able to know:
  - 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 **10 hours**

Introduction – Scope of Geology – origin andage of earth, interior of earth Definition of weathering and erosion, geological work of, river, glacier and wind continental drift, plate tectonics – definitions of atmosphere, lithosphere**.**

Unit 2 **10 hours**

Crystallography – Definition, , symmetry elements, description of crystal classes, systems – Mineralogy – Definition of mineral, chemical composition and physical properties of minerals – Petrology – Definition, Igneous Petrology, types, origin, structures of igneous rocks – Sedimentary rocks – , classification, textures, structures Sedimentary rocks – Metamorphic rocks – agents, types , zones, grades and structures of Metamorphic rocks.

Unit 3 **10 hours**

Structural Geology – Definition, of Folds, Faults, Joints, unconformity, dip, strike. –Definition of Economic geology, importance of economic minerals, ore minerals, gangue minerals (gangue). Ore and industrial minerals. Classification of mineral deposits - Bateman's classification modified by Jensen – Stratigraphy & Indian Geology – Principles, Geological Time Scale, Physiographic divisions of India, Dharwar, Cuddapah, Vindhyan.

Unit 4 **8 hours**

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

Unit 5 **10 hours**

Geochemistry – Introduction, idea of periodic table 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, Introduction to GIs components of GIS.

Suggested Readings

- Text Book of Geology – G.B.Mahapatra
- Engineering and General Geology – Parbin Singh

R 23	Course - 4	L	P	T	C
	Physical geology and Soil science **Course code: 4**	3	1	--	4
Total Contact Hours – 48					

Course Objectives:

- To give knowledge about the solar system, origin of the earth, age of the earth and various physical phenomenon occurring on the planet earth.
- To introduce fundamental aspects of Earth and Planetary system and its related changes with time.
- To associate the naturally occurring land forms with erosive and depositional action of the rivers, wind and glaciers.
- To give knowledge about the Soil types and their parent material, distribution of various soils in India.
- Physical and chemical characteristics different soil types.

Learning Outcomes:

- The student will learn how the solar system originated and about the planet earth in particular, Age of earth.
- Student will get a complete idea about the various physical phenomenon occurring for shaping the planet earth.
- Gain Knowledge about the history of Earth's development,
- Know the solar system; Earth's structure and composition, geological timescale, weathering,
- Know the process of soil formation, Geospheres, depositional and erosional features associated with various natural agent
- Student also get the complete picture of soils and their parent material, physical and chemical properties of the soils, their distribution in India.

SYLLABUS

Unit 1 **10 hours**

General characteristics Solar System and its planets. The terrestrial Meteorites and Asteroids. Earth in the solar system - origin, size, shape,mass, density, age of the Earth. And internal structure of the earth; Formation of core, mantle, crust; Definition of weathering - types of weathering of rocks - Physical and chemical; Definition of erosion and denudation.

Unit 2 **10 hours**

Rivers: Erosion, transportation and deposition of river (fluvial) cycle different stages –Development of typical land forms by river erosion and deposition Glaciers: Definition of a glacier - types of glaciers - development of b typical and forms by glacial erosion and deposition Groundwater: storage of ground water - porosity, permeability, aquifer, water table, zone of saturation, - development of typical land form by erosion and deposition by groundwater [Karst topography] sinkhole, cavern, Stalactites and stalagmites.

Unit 3 **10 hours**

Volcanoes: Types, products and distribution. Earthquakes - intensity, causes, earthquake belts and distribution. , Earthquakes:Cause, kinds of earthquake waves, and mode of propagation, intensity of earthquakes, Ritchers scale - seismograph and seismogram. Effects of earthquakes, earthquake. Wind: Development of characteristic features by wind (arid cycle), erosion and deposition - pedestal rock - mushroom topography - Incelberg - Ventifacts - sand dunes.

Unit 4 **9 hours**

Soil – Introduction origin of various types of soils with emphasis on parent rocks, distribution of various types of soils in India - Soil structure – genesis, types, characterization and management Soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting – mechanism – Soil Physical Properties

Unit 5 **9 hours**

Water flow in saturated and unsaturated soils, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils. Soil suitability analysis for various land use patterns.

Suggested Readings

- Baver LD, Gardner WH & Gardner WR. 1972. Soil Physics. John Wiley & Sons.
- Ghildyal BP & Tripathi RP. 2001. Soil Physics. New Age International.
- Hanks JR & Ashcroft GL. 1980. Applied Soil Physics. Springer Verlag.
- Hillel D. 1972. Optimizing the Soil Physical Environment toward Greater Crop Yields.
- Academic Press.

R23	Course-5/Semester - III	L	P	T	C
	CRYSTALLOGRAPHY & MINERALOGY **Course code: 5**	3	1	--	4
Total contact hours - 48					

Course 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.
- The paper aims to provide understandings of the basics of mineralogy
- Describe the concepts of optical phenomena in thin sections of minerals

Learning 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.
- Learn the identification of minerals, in hand and in thin-section under Microscope.
- Understand the fundamental of crystallography. Including crystal structures and forms Learn the crystals formation, form, Symmetry of normal crystal classes.

SYLLABUS

Unit 1 **10 hours**

Elements of Crystallography – Derivation of 32 Crystal classes, twin laws and twin crystals, Classification of crystals into systems. I.Cubic system – Galena type II. Tetragonal system - Zircon typ III. Hexagonal system - Beryl type IV**.** Trigonal system - Calcite type. V. Orthorhombic system - Barites type VI. Monoclinic system - Gypsum type - VII. Triclinic system -Axinite type

Unit 2 **10 hours**

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

Unit 3 **10 hours**

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

Unit 4 **9 hours**

Nature of light rays, internal reflection, double refraction, interference and polarization. Nicol prism and its constriction – concept of crossed Nicols Petrological microscope (Polarising) - its mechanical and optical parts. Preparation of thin section of minerals and rocks.

Unit 5 **9 hours**

Snell's Law – refractive index, Critical angle – Total Reflection, Pleochroism, Extinction, optic axial angle, Uniaxial and biaxial minerals, Gypsum plate, Quartz wedge and mica plate.**12 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.

R 23	Course-6/Semester - III	L	P	T	C
	Palaeontology **Course code: 6**	3	1	--	4
Total Contact Hours – 48					

Course Objectives:

- To inculcate knowledge of fossils, process of fossilization, their identification and uses.
- The major objectives of this course are to understand the fossilized ancient invertebrate, vertebrate in the light of their morphology, adaptation, ecology, and evolution.
- The present course will also throw light on the evidences and records of the earliest life on the earth and major event in the course of evolution of life through the Geological time.

Learning Outcomes:

- Students will get a complete knowledge about fossils, fossilization process, types, distribution and uses of fossils identify older life forms with their external and internal features; deduction of ecology with the application of morphological modifications, and apply principles of speciation and evolution.

SYLLABUS

Unit 1 **10 hours**

Definition of Paleontology, Branches of Paleontology, Fossilization and fossil record - Nature and importance of fossil record; Fossilization processes - and modes of preservation - Species concept with special reference to paleontology, uses of fossils.

Unit 2 **10 hours**

Brief introduction to important invertebrate groups (Bivalvia, Gastropoda, Brachiopoda) and their biostratigraphic Significance of ammonites in Mesozoic biostratigraphy and their paleo, bio geographic implication.

Unit 3 **10 hours**

Detailed study of morphology, classification and geological distribution of Trilobita, Echinodermata. Origin of vertebrates and major steps in vertebrate evolution. Mesozoic reptiles with special reference to origin diversity and extinction of dinosaurs.

Unit 4 **9 hours**

Scope of paleobotany, taxonomy of plants, Gondwana flora and their significance. Glossopteris, Gangamopteris, Ptylophyllum. Utility of palynological studies in different fields.

Unit 5 **9 hours**

Application of fossils in Stratigraphy - Biozones, index fossils, correlation - Role of fossils in sequence stratigraphy - Fossils and paleoenvironmental analysis. Graptolites- Monograptus and Diplograptus.

REFERENCE BOOKS:

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

R 23	Course-7/Semester - III	L	P	T	C
	FOSSIL FUELS Course code: 7	3	1	--	4
Total Contact Hours – 48					

Course Objective:

- ✓ 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.

Learning Outcome:

- ✓ 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.

SYLLABUS

Unit 1 **10 Hours**

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

Unit 2 **10 Hours**

Petroleum – Origin- inorganic and organic theories – migration and accumulation of oil, Composition of Oil. Petroliferous basins of India. Geology of the productive oil fields of India. Status of Oil and Natural Gas in India- Gas Hydrates.

Unit 3 **10 Hours**

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.

Unit 4 **9 Hours**

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.

Unit 5 **9 Hours**

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

Reference Books

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.
5. Ritchie, Hannah; Roser, Max (28 November 2020). "Energy". Our World in Data.

R 23	Course-8/Semester - III	L	P	T	C
	ELEMENTS OF PETROLOGY Course code: 8	3	1	--	4
Total Contact Hours - 48					

Course 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.
- ✓ The course is intended for students to gain an understanding of the fundamental petrologic processes and common rock types, their origin, texture and structure, their thermodynamic equilibrium and their importance

Learning Outcomes:

- ✓ Understand the petrogenesis of igneous rock
- ✓ Learn about the magmatic differentiation processes,
- ✓ Can understand the difference between various types of sedimentary rocks
- ✓ Know the Process and control of physico-chemical and compositional control on metamorphism of rocks.
  Relating tectonic setting with metamorphism

SYLLABUS

Unit 1 10 Hours

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.

Unit 2 10 Hours

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

Unit 3 10 Hours

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.

Unit 4 9 Hours

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

Unit 5 9 Hours

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.

REFERENCE BOOKS:

1. Igneous and Metamorphic Petrology – Turner and Verhoogen
2. Petrology of Igneous and Metamorphic rocks – Hyndman
3. 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.

R23	Coure-9/Semester - IV	L	P	T	C
	FIELD GEOLOGY **Course code: 9**	3	1	--	4
Total Contact Hours-48					

COURSE 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.

Learning 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 Toposeet in the field, Field mapping etc.

SYLLABUS

Unit 1 10 Hours

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

Unit 2 10 Hours

Topographic Maps – Survey of India Maps, Scale of Maps, Numbering the Toposheets – Conventional, Advanced numbers - Depiction of Relief – Latitudes and Longitudes – Map Grids – Measurement of Mapped areas.

Unit 3 10 Hours

Field guides - Preliminary observations –Geological Cross sections. Contouring- Definition, internal characteristic, direct and indirect methods of contouring and uses.

Unit 4 9 Hours

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

Unit 5 9 Hours

Basic Field Procedures – Location – Outcrops, Soil colour, rock type– Field identification of Rocks – Basic Field Observation, Field Photographs. Documentation

Suggested Readings

Field Gology – F.H.Lahee

Guide to Field Geology – S.M.Mathur

R 23	Course-10/Semester-IV	L	P	T	C
	Igneous, Sedimentary and Metamorphic Petrology Course Code-10	3	1	--	4
Total Contact Hours-48					

Course 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.
- ✓ The primary objective of the course is to train students in identifying common rocks and help the student to learn in detail the different igneous rocks, the petrogenetic processes.
- ✓ The primary objective of the course of metamorphic petrology is to introduce fundamental understanding of process, reaction, mineral assemblage formed in different protoliths during metamorphism.

SYLLABUS

Unit 1 10 Hours

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

Unit 2 10 Hours

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

Unit 3 10 Hours

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.

Unit 4 9 Hours

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

Unit 5 9 Hours

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

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

R23	Course-11/Semester-IV	L	P	T	C
	STRUCTURAL GEOLOGY **Course Code: 11**	3	1	--	4
Total Contact Hours – 48					

Course Objectives:

- ✓ To inculcate knowledge on principles and mechanics of structural deformation of rocks, types of structural deformations, their advantages, disadvantages.
- ✓ The course deals with geological structures resulting from the action of forces on rocks.
- ✓ The course is intended for student to gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of geological structures that result through the deformation processes operative within the earth.

Course Outcomes/Learning Outcomes:

- ✓ Student will get a complete knowledge on principles and mechanics of structural deformations of rocks, types of deformations, their advantages and disadvantages.
- ✓ This course helps the students to understand how to use structures and appreciate the dynamic nature of the Earth's lithosphere.
- ✓ The students will learn the skills of identifying different structure and will be acquainted with field measurements required for geological mapping, learn how to read geologic maps and solve simple map problems and preparations of cross sections

SYLLABUS

Unit 1 10 Hours

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.

Unit 2 10 Hours

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

Unit 3 10Hours

Unconformities – types of unconformities, criteria for recognition and significance of unconformities. Lineation, small scale folds. Application of primary sedimentary and igneous structure in structural geology

Unit 4 09 Hours

Structural association, salt domes, diapers, nappe, tectonic mélanges. Tectonic aspects of Igneous rocks. Geometric classification of plutonic igneous rocks, tectonic setting of plutons. 12hrs

Unit 5 09 Hours

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

REFERENCE BOOKS:

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.

R 23	Course-12/ Semester - V	L	P	T	C
	ECONOMIC GEOLOGY Course code: 12	3	1	--	4
Total Contact Hours – 48					

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, and distribution, physical and chemical properties of economic minerals.

Unit 1 **10 hours**

Definition of ore, ore minerals and gangue in economic geology; Tenor of ores; Ore forming minerals – metallic and non-metallic Classification of mineral deposits - Bateman's classification modified by Jensen. Processes of formation of mineral deposits endo genetic and exogenetic processes Processes of formation of mineral deposits Magmatic concentration, contact metasomatic, , hydrothermal process.

Unit 2 **10 hours**

Sedimentation, residual concentration, mechanical concentration, oxidation and supergene sulphide enrichment and metamorphism. Study of ore deposits of gold, copper, with respect to their mineralogy, uses mode of occurrence, origin and distribution in India.

Unit 3 **9 hours**

Study of ore deposits of Iron, manganese, chromium, lead, zinc, aluminium uranium and thorium with respect to their mineralogy, uses mode of occurrence, origin and distribution in India.

Unit 4 **10 hours**

Study of important industrial minerals of India with particular reference to the industries - abrasives ,cement, glass and ceramics, refractory, fertilizer . Processes of formation, geological occurrence, uses and distribution of coal and petroleum in India .

Unit 5 **9 hours**

A brief study of atomic minerals; uranite, pitchblende coffenite- Beach sands ;monazite ilmenite , rutile

and zircon and their use Mineral Resources of Andhra Pradesh.

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.

R 23	Course-13 / Semester - V	L	P	T	C
	STRATIGRAPHY AND INDIAN GEOLOGY	3	1	--	4
Total Contact Hours – 48					

Course objectives:

A "Stratigraphy and Indian Geology" course typically aims to provide students with a comprehensive understanding of the Stratigraphic principles and rock formations within the Indian geological context, including the ability to identify, classify, and correlate different rock layers, interpret their depositional environments, and understand the evolutionary history of the Indian subcontinent through geological time, often with a focus on key Stratigraphic units and their economic implications

Learning Outcomes

Students will be able to understand

- The age of the Earth
- The relationship between rocks and time
- The geological history of India
- The economic value of rock formations

Unit 1 10 hrs

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

Unit 2 10 hrs

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 Zanskar Stratigraphy. Structure of Gondwana basins.

Unit 3 10 hrs

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

Unit 4 8 hrs

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

Unit 5 10 hrs

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.

Suggested Readings

Krishnan,M.S.(1982) Geology of India and Burma, CBS Publishers, Delhi

Ramakrishnan, M. &Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.

Boggs, S.(2001):Principles of Sedimentology and Stratigraphy, Prentice Hall.

R 23	Course-14/ Semester - V	L	P	T	C
	MINERAL EXPLORATION AND MINERAL ECONOMICS	3	1	--	4
Total Contact Hours – 48					

Course Objective:

The course is intended to provide the student essential and basic concepts of mineral exploration techniques, sampling methods, ore reserve estimation and mining methods.

Course Learning Outcome: The students are expected to learn basic scientific techniques involved in the exploration of mineral deposits and various exploitation methods. They are expected to have knowledge about policies related to mining activities and conservation of mineral deposits.

Unit 1 **10 Hours**

Definition and scope of mineral prospecting and exploration, stages of Mineral exploration – Methods of choosing target area - Criteria for accepting or rejecting the target area - Guides to ore search – Stratigraphic, Lithological, Geomorphological and Structural. Geo-botanical guides.

Unit 2 **9 Hours**

Detailed study of Geophysical methods of Exploration – Magnetic method, Seismic method, Gravity method, Resistivity method and radioactive method - Geochemical prospecting: primary and secondary dispersion – Geochemical association and path finder's

Unit 3 **10 Hours**

Sampling Technique: Definition of sampling, Methods of sampling – Channel, Chip, Grab, Car, groove, Wagon, Pitting and trenching, Drilling and Logging Core and non-core drilling. Coning and quartering. Estimation of ore reserves- Calculation of ore reserves (Extended and Included area methods. Ore reserve estimation, UNFC classification of mineral reserves.

Unit 4 **9 Hours**

Photogeology – Aerial photographs, aerial photographic techniques in menial exploration. Remote Sensing applications in various stages of mineral exploration-Spectral characteristics of alteration minerals color ratio images using digital image processing. Study of satellite imageries

Unit 5 **10 Hours**

Introduction: Principles of mineral Economics. Classification of mineral deposits: Essential, Strategic and Critical minerals of India-Economic importance of mineral industry, National Mineral Policy. Mineral Concession Rules. Mineral Conservation and substitution. Marine Mineral Resources, Law of Sea. Status of mineral production in India. Mineral based industries of Andhra Pradesh.

Reference Books:

1. Introduction to Geophysical prospecting – Dobrin, M.B.
2. Introduction to Exploration Geochemistry – Levinson, A.S.
3. Image Interpretation in Geology – Drury, S.A.
4. Remote Sensing Principles and Interpretation – Sabins, F.F.

R 23	Course-15/ Semester - V	L	P	T	C
	HYDROGEOLOGY	3	1	--	4
Total Contact Hours – 48					

Course Objective:

- What is hydrogeology, what are its principles, what is hydrologic cycle, percolation, recharge, storage, movement of groundwater, potable water, irrigation water etc were discussed.
- To provide knowledge on methods of ground water exploration, geophysical methods, their advantages, and disadvantages.

Course Learning Outcome:

Student will get a complete knowledge on hydrogeology, its principles, hydrologic cycle, precipitation, percolation, recharge, storage, movement of groundwater. Students will get complete knowledge on methods of groundwater exploration.

SYLLABUS

Unit 1 **9 Hours**

Origin of water – Meteoric Juvenile, magmatic and sea waters – Hydrologic cycle – Precipitation, Runoff, infiltration and evapotranspiration, Subsurface movement and vertical distribution of groundwater, Springs.

Unit 2 **10 Hours**

Classification of aquifers. Occurrence of groundwater, Rocks affecting groundwater occurrence – Hydrological properties of rocks – Specific Yield, Specific Retention, Porosity, Hydraulic conductivity, transmissivity, Storage Coefficient, Hydrographs - Groundwater movement, Darcy's law, and its applications.

Unit 3 **10 Hours**

Ground water investigations; Geological investigations and Hydrological investigations. Management of ground water; ground water balance, natural and artificial recharge of ground water. Ground water provinces of India and Andhra Pradesh.

Unit 4 **9 Hours**

Basic concepts and scope of geophysical exploration for groundwater. Surface geophysical method: Electrical resistivity method-The Schlumberger array, the Wenner array, seismic refraction method, Gravity method and magnetic methods.

Unit 5 **10 Hours**

Groundwater Quality: Physical, Chemical, and bacteriological parameters; Quality criteria for groundwater use, graphical presentation of water quality data – National and International water quality standards – potable water, irrigation water – Saline Water intrusion in coastal aquifers. Problem of arsenic and fluoride, case studies.

REFERENCE BOOKS:

1. Groundwater Hydrology – Todd, D.K.
2. Applied Hydrogeology – Fetter C.W. 3. Groundwater Assessment and Development and Management – Karanth, K.R.

R 23	Course-16/ Semester - VII	L	P	T	C
	ATMOSPHERIC SCIENCE	3	1	--	4
Total Contact Hours – 48					

Course Objective:

To provide knowledge about meteorology, climatology, atmosphere, Weather forecasting.

Course Learning Outcome:

Students will get a complete knowledge on meteorology, climatology, atmosphere, Weather forecasting.

Unit 1 **10 Hours**

Introduction – Branches of Atmospheric Science - Atmosphere – Classification – Meteorology, Climatology - Circulation – Clouds, Precipitation, Acid rains – The Air – Masses.

Unit 2 **10 Hours**

Structure of the atmosphere and its composition, Thermodynamic state: distribution of temperature, density, pressure, water vapor, salinity, etc., Equations of state, Planetary Atmospheres Basics of Fundamental forces in the atmosphere and ocean, Formation of Cloud droplets and Precipitation, Radiation basics and budget, Aerosol-Cloud interaction and Ozone depletion,

Unit 3 **9 Hours**

Climate – Types of Climate – Tropical, Dry, Temperate, Continental and Polar - Cyclones – Anticyclones – Tropical cyclones – Tornadoes.

Unit 4 **10 Hours**

Natural regions of the world – Tropical regions - Warm Temperate regions – Cold temperate regions – Polar regions.

Unit 5 **9 Hours**

Weather forecasting. Economic importance of weather - Agriculture and Industry.

Reference Books:

1. An Introduction to Earth and Environment by A.K.Sinha
2. Atmospheric Science, An Introductory Survey, John M. Wallace, Peter V. Hobbs
3. Meteorology, An Atmospheric Science, Dorothy Rambola,

R 23	Course-17/ Semester - VII	L	P	T	C
	GEOCHEMISTRY	3	1	--	4
Total Contact Hours – 48					

Course Objectives:

1. Understand the fundamental principles of geochemistry
2. Apply geochemical principles to understand Earth's processes and systems
3. Analyze and interpret geochemical data
4. Develop problem-solving skills in geochemistry

Course learning outcomes:

- **Understanding the distribution of elements:**
  - ✓ Identify the major and trace elements in Earth's crust, mantle, and core, and explain how their abundances vary across different geological environments.
- **Chemical thermodynamics and kinetics:**
  - ✓ Apply basic principles of thermodynamics and kinetics to analyze geochemical reactions, including mineral stability, fluid-rock interactions, and weathering processes.
- **Isotope geochemistry:**
  - ✓ Interpret the use of stable and radiogenic isotopes to determine ages of rocks, trace element sources, and past environmental conditions.
- **Geochemical cycles:**
  - ✓ Explain the major global element cycles (carbon, nitrogen, oxygen, sulfur) and how they are interconnected with geological and biological processes.

Unit 1 **10 Hours**

Introduction to geochemistry – its scope. Cosmic abundance of elements, geochemical evolution of the earth. Composition of planets and meteorites. Structure and composition the Earth. Geochemistry of hydrosphere, biosphere, lithosphere and atmosphere. Gold Schmidt Geochemical classification of elements and Geochemical Cycle.

Unit 2 **9 Hours**

Elementary crystal chemistry and thermodynamics. Principles of ionic substitution in minerals. Ionization potential. Pauling's rule, Periodic Table with special reference to Rare Earth Elements (REE) and its abundance in the crust. Geochemistry of Uranium & Lithium**.**

Unit 3 **10 Hours**

Introduction to isotope geochemistry, stable isotopes, geochemistry of carbon, oxygen, sulfur Isotopes, Radiogenic Isotopes, Decay scheme of K-Ar, U-Pb and Rb-Sr, Carbon dating and its applications to Geology.

Unit 4 **10 Hours**

Geochemical prospecting: Fundamental concepts, pathfinder elements. Threshold values, geochemical anomaly. Primary and secondary dispersion Halos sampling. Geochemical methods for prospecting of metallic minerals, petroleum and natural gas.

Unit-5 **9 Hours**

The hydrological cycle, inter relationship of surface and ground water, physico-chemical properties of water and its structure and bonding. Solution and solubility, composition of natural waters, some characteristics of river waters and ground water. The mass of the biosphere: composition of the biosphere: biogenic deposits; geochemical cycle of carbon.

Reference books

1. Introduction to Geochemistry – Mason, B. and Mooro
2. Introduction to Geochemistry – Krankopf, K.B.
3. Principles of Isotope Geology – Faure, G.
4. Introduction to Crystal Chemistry - Evans, R.C.
5. Geochemistry- Arthur H. Brownlow.

R 23	Course-18/ Semester - VII	L	P	T	C
	MARINE GEOLOGY	3	1	--	4
Total Contact Hours – 48					

Programme objectives:

To provide valuable information on Marine geological investigations, ocean floor topography, physical and chemical properties of sea water.

Programme outcomes

Student will get a complete knowledge in Marine geological investigations, ocean floor topography, physical and chemical properties of sea water.

Unit 1 **10 hours**

Introduction and Historical Development of Marine Geology, Scope and Application of marine geology , Movements of Ocean Waters. Physical and Chemical Characteristics of Different Ocean Waters. Morphology of the Ocean; Oceanic Crust Structure, Petrology and Sources of Oceanic Crust and Evolution of Oceanic Crust.

Unit 2 **10 hours**

Ocean Floor topography-- Continental margins: continental shelf and slope, its origin, continental rise; Submarine canyon and their origin, Oceanic ridges: Ridges, fracture zones; Ocean basins: Abyssal plains, Abyssal hills, Seamounts and guyots, Marginal trenches. Submarine volcanism, Tsunamis – causes and effects.

Unit 3 **9 hours**

Deep Sea Sediments and Classification; Terrigenous; Biogenic and Authigenic Sediments. Surface and Bottom Currents. Types of Currents: Cold Currents, Warm Currents, Turbidity Currents, calcium Carbon Compensation Depth (CCD) deep ocean Poly Metallic Nodules (PMN) Mineralogy & Genetic and Economic Aspects**.**

Unit 4 **10 hours**

Sea-Coast-Classification; -Physiographic Features along the Coast: Dune, Backshore, Berm, Foreshore & Offshore Near shore Geological Processes Sea-Level Changes, Marine Pollution. Law of the Sea. Coastal Regulatory Zone (CRZ. Coral reefs. Coastal Pollution , Mitigation and Management- Coastal Erosion and Protection measures..

Unit 5 **9 hours**

Sediment History of the Ocean Basins of Pacific, Atlantic and Indian Oceans, Red Sea and Mediterranean Sea. Oceanic circulation -, Surface intermediate and deep ocean circulation; Important phenomena associated with surface circulation.

ReferenceBooks:Shepard,Submarine geology

1. Krunen,Marine geology
2. King,Introductiontomarinegeologyandgeomorphology
3. Keen,Introductiontomarinegeology
4. JamesKennet,Marinegeology,1982,prenticehall
5. RileyandChester,Introduction tomarine chemistry

R 23	Course-19/ Semester - VII	L	P	T	C
	MINING METHODS AND MINE PLANNING	3	1	--	4
Total Contact Hours – 48					

Course Objective:

The subject is offered as one of the elective under skill oriented category, it is designed to provide information on types of mining, open cast mining, underground mining, mine planning, mine safety and health administration.

Course Learning Outcome: Student will get a complete knowledge on types of mining, open cast mining, underground mining, mine planning, mine safety and health administration.

Unit 1 **10 hours**

Introduction to Mining- Types of mining methods – Alluvial mining – Pan and Batea – Long tom – Sluicing (Ground Sluicing) – Derrick and cable way – Hydraulicking –Drift mining – Fore poling and Dredging Mine supports, Subsidence, Methods of breaking of rocks, Mine atmosphere, Ventilation, Drainage, Pumping,. Mining hazards and safety measures.

Unit 2 **9 hours**

Open cast mining or quarrying – Bench mining, Glory Hole mining, Kaolin mining; Strip mining – Rippling , Drilling and blasting , Power shovels, Dumpers, Scrapers , land dredges bucket wheel excavators, conveyor belt , Impact on Environment-Health issues –Remedies

Unit 3 **10 hours**

Underground Coal Mining – Classification of underground Coal mining methods – Panel system , Board and pillar method, Long wall advancing, Long wall retreating , Horizon mining , Strip mining , mine supports , Lighting, Ventilation.

Unit 4 **9 hours**

Underground metal mining – Shaft Sinking methods, Gophering , Breast stopping, Open over hand Stopping , Open underhand Stopping , Underground Glory hole mining , Pillar and Chamber method, Sublevel Stopping method, Drifting.

Unit 5 **10 hours**

Mine Planning - Resource Estimation – Geological Modelling – Block model estimation – Nearest neighbor method – Advantages and disadvantages – Resource block model – Mine Site Evaluation – Mine Design, Equipment selection and Layout planning – Production scheduling and control system – Mine Management System – Mine Safety and Health Administration.

Reference Books:

1. Surface and underground excavations – R. R. Tatiya
2. Principles and practices of modern coal mine-R. D. Singh
3. Mineral Deposit Evaluation: A practical approach by Alwyn E. Anne
4. Courses in Mining- Arogya Swamy

R 23	Course-20/ Semester - VII	L	P	T	C
	Sampling and Geological Mapping	3	1	--	4
Total Contact Hours – 48					

Course Outcomes:

- To make the students realize the importance of field work; read the topographic map.
- To give a generalized idea about different geological mapping and sampling techniques.
- Brief the students the different techniques

Learning outcomes from geological mapping and sampling include the ability to: accurately identify and classify rock types, interpret geological structures like faults and folds, collect representative rock samples, record field data meticulously, construct geological maps and cross-sections, analyze data to understand the geological history of an area, apply geological principles to solve real-world problems, and effectively communicate findings through maps, diagrams, and written reports; essentially, developing a comprehensive understanding of the Earth's subsurface by collecting and interpreting field data through systematic mapping and sampling practices.

SYLLABUS

Unit-1 **10 Hours**

Sampling methods- Chip channel, trench, cutting and underground mine samples. Methods of drilling- diamond, core, rotary, percussion and auger drilling. Evaluation of sampling data Mean, mode, median, standard deviation and variance

Unit-2 **9 Hours**

Bore hole problems. Preparation of mine plans - Drilling and Logging - Core and non-core drilling Planning of bore holes and location of boreholes on ground Core-logging.

Unit-3 **10 Hours**

Types of maps- topographic, geologic and aerial photographs. Study of toposheets. scale of map, map references (indexing), orienting the map, locating the position of outcrops on a map, symbols used for rock types and various structural features – an outline on preparation of geological map and report. Basic field procedure. Measurement and recording of field data.

Unit-4 **10 Hours**

Determination of slopes and gradient, measuring differences in elevation. Basic field observations at a point or out crop. Geological mapping – General considerations, reconnaissance, study of surface features and rocks. Finding and tracing the contacts between rock units, Strike, Dip, apparent dip, rock trends.

Unit-5 **9 Hours**

Transfer of field data collected on to a base map, finalization of map, preparation of geological cross section. Contouring – Definition, internal characteristics, direct and indirect methods of contouring and uses. Application of GIS in Mapping.

ReferenceBooks:

1. FieldGeology–Lahee
2. BasicFieldGuide–S.M.Mathur

R 23	Course-21/ Semester - VIII	L	P	T	C
	ENERGY RESOURCES	3	1	--	4
Total Contact Hours – 48					

Course Objective:

The subject is designed to provide information on Energy sources on the earth, renewable and non-renewable energy resources, Petroleum, Natural gas, Coal, Atomic minerals.

Course Learning Outcome:

Student will get complete information on Energy sources on the earth, renewable and non- renewable energy resources, Petroleum, Natural gas, Coal, Atomic minerals.

Unit 1 **10 hours**

Definition of Energy: Primary and Secondary Energy Difference between Energy, Power and Electricity Renewable and Non-Renewable Sources of Energy The concept and significance of Renewability: Social, Economic, Political and Environmental Dimension of Energy.

Unit 2 **10 hours**

Petroleum – Origin- inorganic and organic theories – migration and accumulation of oil and gas – 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

Unit 3 **9 hours**

Coal – Origin and classification – Chemical characterization — Gelogical and Geographical distribution of coal deposits in India. Detailed Geology for important coal fields of India. Hazards of Coal Mining and Safety Measures.

Unit 4 **10 hours**

Atomic minerals – Mode of occurrence and association with other radioactive minerals. Methods of prospecting and productive geological horizons in India. Detailed Geology and Distribution of Uranium deposits in India. Atomic fuels and environment.

Unit 5 **9 hours**

Renewable Energy resources – Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based power and Energy.

Reference Books:

1. All you wanted to know about Disasters – (Brig) H.K.Kanna
2. Petroleum formations and occurrences – Tissort, B.P. and Welte D.H.,
3. Text book of coal – Chandra, D.
4. Uranium ore deposits – Dahlkamp F.J.
5. Petroleum Geology – Laverson, P.

R 23	Course-22/ Semester - VIII	L	P	T	C
	NATURAL HAZARDS & MANAGEMENT	3	1	--	4
Total Contact Hours – 48					

Programme objectives

To inculcate knowledge on natural hazards, manmade hazards, earthquakes, floods, tsunami, volcanic eruption. Further it is designed to taught how these natural hazard scan be managed to cause minimum damage to the mankind.

Programme outcomes

Student will get complete knowledge geo natural hazards, man made hazards, earthquakes, floods, tsunami, volcanic eruption .and management natural hazards to cause minimum damage to the mankind.

Unit 1 **10 hours**

Natural Hazards: Earthquake concepts, hazards mitigation case histories preferably Indian Man Made Hazards, Wildfire - concepts hazards mitigation case histories preferably Indian.

Unit 2 **10 hours**

Flood types and its management, drought types and its management, - Cyclone Concepts, severe local storms, lightning Prediction and hazard assessment.

Unit 3 **10 hours**

Tsunami-concepts, Tsunami Generation and Movement, hazards mitigation case histories preferably Indian; tornado, lightning Prediction and hazard assessment, mitigation case histories preferably Indian.

Unit 4 **10 hours**

Volcanic hazards, origin and types of volcanic activity, nature of volcanic hazards, Prediction of volcanic eruptions, Mitigation of volcanic hazards.

Unit 5 **10 hours**

Classification, causes of landslides, controls of landslides subsidence and its importance, site selection for ghatroads. Determination of cause active factors for soil erosion, Soil conservative measures.

ReferenceBooks:

1. GeoffL.Wells,1997,Major HazardsandTheirManagement,GulfPublishingCompany,305p.
2. EnvironmentalGeology-Keller.E.A(1976).
3. EnvironmentalGeology-IndianContextK.SValdiya(1987)
4. EnvironmentalGeology- C.W Montgomery(1989).
5. SimonRoss,1998,NaturalHazards,NelsonThornes Ltd,USA,96p.4

R 23	Course-22/ Semester - VIII	L	P	T	C
	ENGINEERING GEOLOGY	3	1	--	4
Total Contact Hours – 48					

Programme objectives

The subject is designed to provide knowledge geo engineering properties of rocks, construction of civil engineering structures, quarrying, construction of dams, tunnels. It also provide knowledge on Remote Sensing Applications on Engineering Geology.

Programme outcomes

Student will get a complete knowledge geo engineering properties of rocks, construction of civil engineering structures, quarrying, construction of dams, tunnels; Furtherhe will get knowledge on Remote Sensing Applications on Engineering Geology

Unit 1 **10 Hours**

Engineering Properties of Rocks & Soil, Role of Geologist in Engineering Construction. Building Materials and Road Construction Materials, Distribution, Nature and Properties of Building stones. Quarrying.

Unit 2 **9 Hours**

Dams and Reservoirs – Classification and Parts of Dams; Systematic Dam Site Investigations case histories – Nagarjuna Sagar Dam and Srisailam Dam: Reservoirs Characters for investigating relative suitability, geological consideration for reservoir sites.

Unit 3 **10 Hours**

Tunnels - Types, Methods of Construction, Systematic Site Investigations and Problems in the Construction of Tunnels , Landslides – Definition, Types, Causes; Stability Analysis and Remedies of Landslides problems of constructing civil engineering structures in area landslides and coastal erosion.

Unit 4 **10 Hours**

Application Remote Sensing and GIS in river valley projects – Dams and reservoirs, site suitability evaluation(lithological,structural of, considerations)– canal and pipe line alignment, tunnels constructions Site suitability (lithological,structura,slope,gradient,economic considerations.

Unit 5 **9 Hours**

Application of Remote Sensing and GIS in seismic hazards, landslides, ghat roads, bridges, culverts, route locations (highway and railroads).

ReferenceBooks

1. Engineeringmaterials–S.C. Rangwala
2. TextBook ofEngineeringGeology–N.Chennakesavulu.
3. PrinciplesofEngineeringGeologyandGeotectonics–D.P.
4. EngineeringGeology– B.S.SatyanarayanaSwamy
5. PrinciplesofEngineeringGeology–K.V.G.K.Gokhele
6. RemoteSensingand Image Interpretation–Lillisand,T.M.,Keifer,R.W.
7. RemoteSensingPrinciplesand Interpretations–Sabins,F.F.

R 23	Course-24/ Semester - VIII	L	P	T	C
	PETROLEUM GEOLOGY	3	1	--	4
Total Contact Hours – 48					

Course Objective:

This paper is provided as one option under Skill Oriented Subjects. It is designed to provide complete knowledge on Petroleum, its source rocks, exploration techniques, classification of reservoir rocks.

Course Learning Outcome:

Student will acquire required knowledge on Petroleum, its source rocks, exploration techniques, classification of reservoir rocks.

Unit 1 **10 hours**

Source Rocks: Definition of source rock, Organic rich sediments as source rocks, Nature and type of source rocks - Claystone / shale, The process of diagenesis, catagenesis and metagenesis in the formation of source rocks, Subsurface pressure temperature conditions for the generation of oil and gas from the source sediments, Oil window.

Unit 2 **9 hours**

Reservoir Rocks: Characteristics of Reservoir rocks, Classification and nomenclature: Clastic Reservoir Rocks, Carbonate Reservoir Rocks, Unconventional, Fractured and Miscellaneous reservoir rocks, Marine and non-marine reservoir rocks.

Unit 3 **10 hours**

Reservoir Properties and Cap Rocks: Reservoir pore space, porosity- primary and secondary porosity, effective porosity, fracture porosity - permeability – effective and relative permeability, Concept of Shale oil. Cap rocks: Definition and characteristics of cap rocks.

Unit 4 **9 hours**

Hydrocarbon migration: Geological framework of migration and accumulation, The concept of hydrocarbon migration from source beds to the carrier beds, Carrier beds to the reservoir, Free path ways for migration-Short distance and long distance migration, Evidence for migration, Oil and gas seepages.

Unit 5 **10 hours**

Entrapment of hydrocarbons: Entrapment and accumulation of hydrocarbons, Classification and types of traps: Structural, stratigraphic and combination type of traps, Traps associated with salt domes. Sedimentary Basins: Sedimentary basins -origin and classification, Types of basins - Tectonic classification, stratigraphic evolution and hydrocarbon accumulations of the following basins: Krishna-Godavari basin, Cambay basin and Mumbai off-shore.

Reference Books:

1. Geology of Petroleum, A.I. Levorsen,2ndEdition. CBS, Publishers, 2006.
2. Elements of Petroleum Geology, Richard, C. Selley,Elsevier, 1997.
3. Sedimentary basins of India- ONGC bulleting.
4. Unconventional Petroleum Geology, CainengZou et al., Elsevier, 2013.

R 23	Course-25/ Semester - VIII	L	P	T	C
	Introduction to Remote Sensing and GIS	3	1	--	4
Total Contact Hours – 48					

Course Objective

This course intends to introduce students to the fundamental principles and techniques of remote sensing, basic properties of electromagnetic radiation and its interaction with matter, fundamentals of digital image processing and image interpretation techniques. The course will also introduce the students to the fundamentals of geographical information system.

Course Learning Outcome

At the end of this course, the student will be appraised with the theoretical knowledge, Information and skills to use remotely sensed data, image processing techniques and application of GIS techniques for geological applications.

SYLLABUS

Unit 1 **10 Hours**

Principles of Remote Sensing: Basic concepts-Electro Magnetic Radiation, Electromagnetic spectrum-Interaction of electromagnetic radiation with atmosphere, Interaction of electromagnetic radiation with Earth surface. Spectral characteristics of vegetation, water and soil. Atmospheric widows, sensors and platforms; advantages and limitations of remote sensing.

Unit 2 **10 Hours**

Satellite data acquisition systems – Platforms-Airborne and Space borne-Sensors-Passive sensors and active sensors- Multispectral scanners. Multispectral Remote Sensing – Resolutions – Spectral, Spatial, Radiometric and temporal – Remote Sensing in Thermal Infra Red and microwave regions.

Unit 3 **9 hours**

Image interpretation: Introduction to Digital Image Processing. Fundamentals of image interpretation. Basic recognition elements in satellite image interpretation. False colour composite (FCC), Aerial photo vs satellite image. Application of remote sensing in geology, geomorphology, mineral exploration and hydro geological studies.

Unit 4 **10 Hours**

Basic concepts: Definition and history, Components of GIS,; Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Rectification, Transformation Methods. Data Types: Spatial Data, Non-Spatial Data.

Unit 5 **9 Hours**

Data Input: Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models: Vector Data Model, Raster Data Model, Integration and Comparison of Vector and Raster Data Models. Recent trends and applications of GIS in Geological studies.

Reference Books

1. Remote Sensing Principles and interpretations–Sabins,F.F.Jr.
2. Remote Sensing and Image Interpretation-Lillisand,T and Kiefer,P.W.
3. Remote Sensing Geology– R.P. Gupta