

COURSES OF STUDIES

M.SC. (GEOLOGY)

**CBCS Pattern INTRODUCED FROM THE SESSION
2015- 16**

KHALLIKOTE AUTONOMOUS COLLEGE

BERHAMPUR- 760001

COURSE STRUCTURE

Paper Code	Topic	Full Marks	Credit Points
	FIRST SEMESTER	500	20
CC-101	General Geology, Geomorphology A, B & Crystallography	80+20	4
CC-102	Mineralogy A, B & Optics A, B	80+20	4
CC-103	Igneous Petrology A, B, C & Petrography of Igneous Rocks	80+20	4
CC-104	Geo-tectonics A, B & Geochemistry A, B	80+20	4
CC-105-P	Practical related to all papers	100	4
	SECOND SEMESTER	500	20
CC-201	Structural Geology A, B, C, D	80+20	4
CC-202	Sedimentary Petrology A, B, Photo-geology & Remote sensing	80+20	4
CC-203	Metamorphic Petrology A, B, Petrography of Sedimentary Rocks & Petrography of Metamorphic Rocks	80+20	4
CC-204	Marine Geology, Environmental Geology A& B, Disaster Management	80+20	4
CC-205-P	Practical related to all papers	100	4

P.G. -II

	THIRD SEMESTER	500	20
CC-301	Palaeontology A, B, C & Quaternary Geology	80+20	4
CC-302	Stratigraphy A & B, Stratigraphy and Palaeogeography	80+20	4
CC-303	Hydrogeology A & B, Engineering Geology A & B	80+20	4
AE-304	Geology of Odisha	80+20	4
CC-305-P	Practical related to all papers	100	4

	FOURTH SEMESTER	500	20
CC-401	Economic Geology- Classification of Mineral deposits & Process of formation of Mineral deposits, Mineral Exploration & Mineral resources of India)	80+20	4
CE-402	Mineral resources of India and Mineral based Industries	80+20	4
CE-403	Coal and Petroleum	80+20	4
CE-404	Ore Geology, Mining and Surveying, Mineral Economics & Geology and Environment	80+20	4
CE-405-P	Practical related to all papers	100	4

FIRST SEMESTER

PAPER – CC101

(General Geology, Geomorphology & Crystallography)

UNIT-I : GENERAL GEOLOGY

Age and origin of the Earth, Seismology and interior of the Earth. Elementary idea about Lunar Geology. Meteorites- Types and components
Volcanoes- Causes, Products and Volcanic belts.
Earthquake- Causes, effects. Earthquake belt and Seismicity of India.

UNIT-II : GEOMORPHOLOGY(A)

Concepts of weathering and erosion, Types of weathering and its Geomorphic significance. Geological work of River, Wind, Glacier. Coastal Geomorphology.

UNIT-III : GEOMORPHOLOGY(B)

Geomorphic cycle(Davis, Penck's), Morphology and its relation to structures and lithology. Drainage pattern. Application of geomorphology in Hydrology, Mineral prospecting, Civil engineering and environmental studies. Geomorphic subdivisions of India.

UNIT-IV : CRYSTALLOGRAPHY

Stereographic projections, symmetry operation, space lattice, derivation of 32 crystal classes. Space group, X-Ray crystallography, Twinning.

PAPER – CC102
(Mineralogy & Crystal Optics)

UNIT-I : MINERALOGY(A)

Classification of Silicate structures. Twinning, Zonal equation. Structure, Chemical, Physical & Optical properties and Feldspar, Olivine.

UNIT-II : MINERALOGY (B)

Structure, Chemical, Physical & Optical properties of Pyroxene, Amphibole, Garnet, Silica, Mica, Feldspathoid group, Alumino silicates and Clay minerals.

UNIT-III : CRYSTAL OPTICS(A)

Snell's Law, Double Refraction, Polarization, Nicol Prism, Isotropism, Anisotropism, Refractive Index. Preparation of thin section, Optic axis(Uniaxial & Biaxial), Optic axial angle.

UNIT-IV : CRYSTAL IOPTICS(B)

Pleochroism, Pleochroic Scheme, Extinction and Extinction angle, Intereference colour, Order of Intereference colour, Uniaxial and Biaxial interference figures, Dispersion, Birefringence.

PAPER – CC103
(Igneous Petrology & Petrography of Igneous Rocks)

UNIT-I : IGNEOUS PETROLOGY(A)

Texture and Structure of Igneous rocks and their petrogenetic significance. Bowen's reaction series, Tabular, IUGS classification of Igneous rocks.

UNIT-II : IGNEOUS PETROLOGY(B)

Magmatic differentiation and assimilation, variation diagrams, Petrographic Province, Magmatism and Tectonics

UNIT-III : IGNEOUS PETROLOGY(C)

Concepts of Magma & its general characters, Crystallisation of uni-component, bi-component magma, eutectic, solid solution(Ab-An), Incongruent melting(Leu-Si) and Ternary magma(Di-Ab-An). Petrology and evolution of Lamprophyre, Anorthosite, Alkaline rocks, Carbonatite and Kimberlite.

UNIT-IV : PETROGRAPHY OF IGNEOUS ROCKS

Petrography and Petrogenesis of the Granites, Pegmatite, Syenite, Diorite, Basalt, Gabbro, Dolerite, Ultrabasic rocks.

PAPER – CC104

(Geotectonics & Geochemistry)

UNIT-I : GEOTECTONICS(A)

Concept of Plate tectonics. Continental drift. Palaeomagnetism and sea floor spreading. Mid oceanic ridge. Island arc. Geosyncline - characteristics, evolution and classification.

UNIT-II : GEOTECTONICS(B)

Isostasy, Gravity anomaly, Orogeny and Epirogeny, Tectonic designs and evolution of Himalayas. Neotectonic movements in India. Tectonic divisions of India.

UNIT-III : GEOCHEMISTRY(A)

Cosmic abundance of elements, Geochemical classification of elements, Structure and Composition of Earth. Major and Trace elements.

UNIT-IV : GEOCHEMISTRY(B)

Solid solution, Ionic substitution, Isomorphism and Polymorphism. Types and composition of Meteorites, Geochemical cycle, Isotope Geochemistry, Lunar Geology.

PAPER – CC105-P

(PRACTICAL related to all theory papers of I Semester)

CRYSTALLOGRAPHY

Stereographic projections of crystals.
MINERALOGY
Megascopic and Microscopic identification of minerals.
IGNEOUS PETROLOGY
Megascopic and Microscopic identification of rocks.
LABORATORY RECORD AND VIVA VOCE

SECOND SEMESTER

PAPER – CC201 **(Structural Geology)**

UNIT-I : STRUCTURAL GEOLOGY(A)

Strike and Dip, concept of stress and strain, stress - strain relationship of elastic, plastic and viscous material. Measurements of strain in deformed rocks. Deformation mechanism, Rule of V's, top bottom criteria, salt dome and diapirs.

UNIT -II : STRUCTURAL GEOLOGY (B)

FOLD- classification, mechanism and recognition in field. Effect of erosion on folded strata.

FAULT- classification, mechanism and recognition in field.
A brief idea about shear zone

UNIT-III : STRUCTURAL GEOLOGY (C)

JOINTS - Classification and significance.

UNCONFORMITY- Types, significance and recognition in field.

UNIT -IV : STRUCTURAL GEOLOGY (D)

Foliation - Types and its relation to major structures.

Lineation- Types and its relation to major structures.

Granite- Tectonics, Tactonites - concept, types and strain significance, plate tectonic environment of tactonite formation

PAPER – CC202

(Sedimentary Petrology, Photo-geology & Remote Sensing)

UNIT-I : SEDIMENTARY PETROLOGY(A)

Sediments, types, diagenesis. Texture and structure of sedimentary rocks and their significance. Heavy minerals studies and their significance.

UNIT-II : SEDIMENTARY PETROLOGY(B)

Classification of sedimentary rocks, sedimentary facies and provenance, sedimentary environment- fluvial, lacustrine, deltaic and marine. Sedimentation and tectonics, sedimentary basins of India.

UNIT-III : PHOTOGEOLOGY

Concept and principles of Aerial photography and photogrammetry, Electromagnetic spectrum. Orbiting satellites and sensor system. Basics of Geographical Information Systems (GIS) and its application, GPS.

UNIT-IV: REMOTE SENSING

Indian remote sensing satellites, satellite data products. Application of remote sensing in structural mapping, ground water studies, mineral exploration.

PAPER – CC203

(Metamorphic Petrology, Petrography of Sedimentary Rocks & Petrography of Metamorphic Rocks)

UNIT- I : METAMORPHIC PETROLOGY(A)

Types and agents of metamorphism, Metamorphic zone, Grade. ACF and AKF diagrams, Phase rule, Texture and structure of metamorphic rocks.

UNIT-II : METAMORPHIC PETROLOGY(B)

Metasomatism. Metamorphic differentiation, Concepts of Metamorphic Facies, Facies of Regional and contact metamorphism of argillaceous and arenaceous rocks.

UNIT-III : METAMORPHIC PETROLOGY(C)

Metamorphism and Tectonics. Granulite terrain of India. Ocean floor metamorphism. cataclastic metamorphism, Granitization, Metamorphic belts of India.

UNIT-IV : PETROGRAPHY OF SEDIMENTARY AND METAMORPHIC ROCKS

Petrography of Sandstone, Limestone, Shale, Conglomerate, Breccia.

Petrography of Gneiss, Schist, Quartzite, Slate, Marble, Khondalite and Charnockite.

PAPER- CC204

(Marine Geology, Environmental Geology & Disaster Management)

UNIT-I : MARINE GEOLOGY

Exploration of sea floor, topography of ocean floor, marine sediments and their classification, marine mineral resources and law of sea. Pollution of marine environment. Man and ocean.

UNIT-II : ENVIRONMENTAL GEOLOGY(A)

Interaction of man and natural system, man's consumption of earth resources and its impact on the natural environment. Impact of mining activities on environment. Waste disposal

UNIT-III : ENVIRONMENTAL GEOLOGY(B)

Pollution and remedial measures, Acid rain. Role of geologists in environmental planning and management. Environmental protection- Legislative measures in India.

UNIT-IV : DISASTER MANAGEMENT

Geohazards and their management (Earthquake, Landslides, Floods, Cyclone, Tsunamis).

PAPER-CC205-P

(PRACTICAL related to all theory papers of II Semester)

STRUCTURAL GEOLOGY

Interpretation of geological maps, Drawing of geological section, completion of outcrop, Structural problems and stereographic plotting of structural elements.

PETROLOGY

Megascopic and Microscopic identification of sedimentary and metamorphic rocks. Calculation of norm and modal analysis. Heavy mineral analysis and interpretation. Grain size analysis.

PHOTOGEOLOGY

Interpretation of Aerial photographs / satellite imagery.

FIELD REPORT - The Geological Field Training Programme is a part of curriculum and it's compulsory for all, failing which they will not be allowed to appear at the Semester Examination.

LABORATORY RECORD AND VIVA VOCE

THIRD SEMESTER

PAPER-CC301

(Palaeontology & Quaternary Geology)

UNIT- I : PALAEOLOGY(A)

Modes of preservation of fossils, geological significance of fossils. Morphology, Classification geological history and Evolution history of Brachiopoda, Pelecypoda, Cephalopoda, Gastropoda. Trilobite,

UNIT- II : PALAEOLOGY(B)

Morphology, Classification geological history and Evolution history of Echinoidea, Graptolitesa and Coral. A brief idea on the evolution of Man, Horse and Elephant. Gondwana flora and its significance.

UNIT- III : PALAEOLOGY(C)

Types of Microfossils, their application in different fields. Study of morphology, classification and ecology of Foraminifers. Morphology of Conodonts and Ostracods.

UNIT- IV: QUATERNARY GEOLOGY

Global Sea level rise - past and future, climate changes in quaternary periods, quaternary deposits and land forms of India. Geological history of Indian subcontinent through Phanerozoic, Pleistocene glaciations- causes and effects, Neotectonism.

PAPER-CC302

(Stratigraphy and Palaeogeography)

UNIT-I : STRATIGRAPHY(A)

Standard stratigraphic time scale, Principles of stratigraphic correlation, code of stratigraphic classification and nomenclature. Stratigraphy of Aravalli Supergroup, Dharwar Supergroup, Easternghats, Pre-cambrian of Singhbhum-Odisha.M.P.,Chhatishgarh.Sausar group, Sakoli Group.

UNIT-II : STRATIGRAPHY(B)

Cuddapah and Vindhyan Supergroup, Gondwana Supergroup , Deccan Traps , Triassic of Spiti, Jurassic of Kutch. Cretaceous of Trichinopoly, Siwalik Group, Tertiary of Assam. Quaternary deposits.

UNIT-III : STRATIGRAPHY AND PALAEOGEOGRAPHY(A)

Stratigraphy of Himalaya, Major boundary problems (Pre cambrian / Cambrian, Cretaceous / Tertiary). Concept of Palaeogeography, paleogeography of India during Permian, Triassic, Jurassic and Cretaceous periods, Climatic and sea level changes during Quaternary.

UNIT-IV: ENGINEERING GEOLOGY (A)

Engineering properties of soils, rocks. Classification of soils. Building stones, Road materials with Indian example.

Dam and Reservoirs- Geological consideration and environmental impact.

Roads and Highways- Geological consideration.

PAPER-CC303 **(Hydrogeology & Engineering Geology)**

UNIT-I : HYDROGEOLOGY(A)

Introduction, Hydrological cycle, Vertical distribution of subsurface water, Aquifer - types, Aquitard, Aquiclude. Porosity, Permeability, Specific yield, Specific retention, Storage coefficient, Darcy's Law.

UNIT-II : HYDROGEOLOGY(B)

Quality of groundwater & Quality criteria for different uses. Pollution of groundwater. Saline water intrusion. Methods of Groundwater Exploration. Groundwater Provinces of Odisha. Groundwater provinces of India

UNIT-III : HYDROGEOLOGY(C)

Tubewell failures - causes and remedial measures. Artificial Groundwater Recharge, Rainwater harvesting, Groundwater development and management.

UNIT-IV : ENGINEERING GEOLOGY (B)

Geological consideration of Tunnel and Bridge side Improvement of site condition (grouting, back filling and soil stabilisation). Earthquake resistant structure. Soil erosion & conservation practices.

PAPER-AE304 **GEOLOGY AND MINERAL RESOURCES OF ODISHA**

UNIT – I Geology of Odisha

Physiography , Rock Types, Structure and Stratigraphy of Odisha.

UNIT – II Mineral Resources of Odisha (A)

Mineralogy, Mode of occurrence, Distribution and Uses of Iron ore, Manganese ore, Chromite, Bauxite.

UNIT – III Mineral Resources of Odisha (B)

Mineralogy, Mode of occurrence, Distribution and Uses of Limestone, Graphite, Gemstones, Coal, Beach sand deposits, Building Stones.

UNIT – IV Mineral Based Industries Of Odisha

Raw materials, Metallurgy, Quality control, Trade and Commerce of Cement industries, Iron and Steel industries, Ferro-chrome Industries.

PAPER-CC305-P

(PRACTICAL related to all theory papers of III Semester)

PALAEONTOLOGY :

Identification of fossils. Drawing and labelling of fossils.

STRATIGRAPHY :

Plotting of stratigraphic units in India and Odisha map.
Stratigraphic assemblages.

ENGINEERING GEOLOGY :

Identification of building stones. Interpretation of maps related to Engineering geology.

HYDROGEOLOGY :

Problems related to groundwater, Water analysis and Quality diagrams.

LABORATORY RECORD AND VIVA VOCE

FOURTH SEMESTER

PAPER-CC401

(Economic Geology- Classification of Mineral deposits & Process of formation of Mineral deposits, Mineral Exploration & Mineral resources of India)

UNIT-I : CLASSIFICATION OF MINERAL DEPOSITS & PROCESS OF FORMATION OF MINERAL DEPOSITS :

Magmatic Concentration, Hydrothermal (Cavity filling & Replacement), Mechanical and Residual Concentration, Oxidation and Supergene Sulphide Enrichment, Sedimentation, Metamorphism, Metasomatism, Sublimation

UNIT- II : MINERAL EXPLORATION

Controls of Ore localisation, Prospecting and Exploration : Geological, Geophysical, Geochemical and Geo-botanical prospecting, Metallogenic Epoch and Province

UNIT-III : MINERAL RESOURCES OF INDIA (A)

Mineralogy, Mode of occurrence, Origin, Uses and Indian Distribution of Iron (with special reference to BIF of Singhum-Bonai-Keonjhar, Karnataka & M.P.), Manganese (with special reference to Jamda-Koira Valley & M.P. and Maharastra), Copper (with special reference to Singhum copper thrust and Khetri belt)

UNIT-IV: MINERAL RESOURCES OF INDIA (B)

Mineralogy, Mode of occurrence, Origin, Uses and Indian Distribution of Chromite (with special reference to Sukinda Chromiferous Belt & Nausahi), Nickel, Lead and Zinc (with special reference to Zawar & Sargipalli), Bauxite (with special reference to East Coast Bauxite deposits), Gold (with special reference to Kolar and Hutti Gold fields)

PAPER- CE402

(Mineral resources of India & Mineral based Industries)

UNIT-I : MINERAL RESOURCES OF INDIA(Non metallic)(A)

Mineralogy, Mode of occurrence, Origin, Uses and Indian Distribution of Mica (with special reference to Koderma [Bihar] Mica Belt, Nellore Mica belt) Talc, Asbestos (with special reference to Pullivendla), Graphite (with special reference to Odisha.

UNIT-II : MINERAL RESOURCES OF INDIA(Non metallic)(B)

Mineralogy, Mode of occurrence, Origin, Uses and Indian Distribution of : Barite (with special reference to Mangampetta) Kyanite (Lapsaburu), Magnesite (Salem). Gypsum , Lime Stone.

UNIT-III : MINERAL BASED INDUSTRY

Raw materials and their Indian distribution of -- Iron and Steel, Refractory, Abrasive.

UNIT-IV: MINERAL BASED INDUSTRY

Raw materials and their Indian distribution of -- Fertiliser, Cement, Glass and Ceramic Industry, Beach Sand Placer deposits of Odisha.

PAPER- CE403 **(Coal and Petroleum)**

UNIT-I : COAL (A)

Introduction, types of Coal, Composition and rank, Formation of Coal, methods of Coal mining and their environmental impacts, elementary idea of Coal Petrography

UNIT-II : COAL (B)

Geological and Geographical distribution of Indian Coal deposits, Study of important coal fields of India – Talchir, Ib, Raniganj, Jharia

UNIT-III : PETROLEUM (A)

Introduction, Reservoir rocks- Types and characteristics. Origin, Migration, Mode of accumulation(Oil trap) and entrapment of petroleum, Structural and Stratigraphic traps, Distribution of petroleum, Exploration of petroleum and environment

UNIT-IV : PETROLEUM (B)

Distribution of Oil and Natural gases in India, Study of important oil fields – Bombay High, Assam, Krishna-Godavari Basin, Gujarat oil fields.

PAPER- CE404

(Ore Geology, Mining and Surveying, Mineral Economics & Geology and Environment)

UNIT-I : ORE GEOLOGY

Ore microscope, Preparation of polished surface. Physical and Optical properties of minerals- Iron, Copper, Chromite, Manganese, Lead and Zinc, Ore textures, Paragenesis & Zoning.

UNIT-II : MINING AND SURVEYING

Ore, Tenor, Grade, Specification, Sampling, Assaying, Ore Reserve Estimation, Common terminologies in Mining, Open Cast and Underground Mining (Board and Pillar, Longwall, Stopping Method), Basic principles of Surveying (Chain and Compass, Plane table).

UNIT-III : MINERAL ECONOMICS

Strategic, critical and essential minerals, Co-Products & Bi-Products. National mineral policy, Mineral conservation and substitution, Mineral Inventory, Mineral legislation in India, Beneficiation of Ore minerals, Sustainable development of mineral resources.

UNIT-IV : GEOLOGY AND ENVIRONMENT

Environmental impacts of Mining, Role of Geologist in environmental planning and management, Application of Remote Sensing techniques in mining and management of environment.

PAPER-CE405-P

(PRACTICAL related to all theory papers of IV Semester)

ORE GEOLOGY

Megascopic and Microscopic Identification of ore minerals.
Chemical analysis of ore minerals.

MINING & SURVEYING

Ore reserve estimation
Surveying- Chain & Compass, Plain table

FIELD REPORT – *The Geological Field Training Programme is a part of curriculum and it's compulsory for all, failing which they will not be allowed to appear at the Semester Examination.*

VIVA VOCE RELATED TO FIELD WORK

LABORATORY RECORD
