GONDWANA UNIVERSITY, GADCHIROLI

Choice Based Credit System (CBCS)

Syllabus of
B. Sc. III (Geology)
(Semester V and VI)
(Three Years Degree Course)

2019-2020
B.Sc.-III Year
SEMESTER – V
Geology
B. Sc. Geology Semester V
DECIPLENE SPECIFIC ELECTIVE

Paper I: (Economic Geology)

Unit I:
Definition of ore, ore minerals and gangue minerals, grades of ores and non-metallic minerals, assay value and tenor of ore. Broad outline of ideas regarding classification of mineral deposits, Principles and processes of formation of mineral deposits: Magmatic concentration deposits; Pegmatitic deposits; Sublimation deposits; Contact metasomatic deposits; Submarine exhalative volcanogenic deposits; Hydrothermal deposits (Cavity filling and replacement).

Unit II:
Principles and processes of formation of following mineral deposits: Residual concentration deposits; Mechanical concentration deposits (Placers); Sedimentary deposits; Evaporites; Bacteriogenic deposits; Supergene sulphide enrichment deposits; Metamorphic and metamorphosed deposits with suitable Indian examples.

Unit III:
Mineralogy, uses, geological occurrences, origin and geographical distribution of the mineral deposits of - Iron, Chromium, Tungsten, Lead and Zinc, Gold, Aluminium, Radioactive minerals. Non-metals related to refractory, fertilizers, cement, chemical, gemstone (Gypsum, Mica, Graphite, Kyanite, Sillimanite, and Diamond).

Unit IV:
Mineralogy, uses, geological occurrences, origin and geographical distribution in India of the following: Manganese, Copper, Natural hydrocarbons, oil and natural gas, Fossil fuels, lignite and coal. Brief account of the geological setting and mineralization of the following: Kolar gold field, Singhbum copper belt, Malanikhand copper deposit, Lead zinc deposit of Zawar, Manganese belt of Maharashtra, Iron ore deposits of Bastar, Bauxite deposits of Maharashtra, Mica deposits of Bihar, and Andhra pradesh. Gondwana coal deposits, Neyveli lignite deposit, Gypsum deposit of Rajasthan and beach placers of Kerala.
Practicals

ECONOMIC GEOLOGY

Study of physical properties and identification of the following minerals in hand specimen:
Native gold, Native Copper, Chalcopyrite, Bornite, Covellite, Cuprite, Malachite, Azurite,
Galena, Anglesite, Cerrusite, Sphalerite, Zincite, Smithsonite, Hematite, Magnetite, Siderite,
Pyrite, Marcasite, Pyrrhotite, Chromite, Pyrolusite, Psilomelane, Braunite, Ilmenite, Wolframite,
Scheelite, Cassiterite, Molybdenite, Stibnite, Realgar, Orpiment, Cinnabar, Uraninite, Bauxite,
Graphite, Asbestos, Barytes, Mica, Talc, Monazite, Beryl, Kyanite, Sillimanite, Gypsum, Clay,
Lignite, bituminous coal and Anthracite

Books recommended:

Economic Geology

5. Deb: Industrial Minerals and Rocks of India.
7. Babu: Tin in India.
8. Babu: Diamonds in India.
9. Radhakrishnan and Curtis: Gold in India.
10. Deshpande: Geology of Maharashtra.
B. Sc. Geology Semester V

DECIPLINE SPECIFIC ELECTIVE

Paper II: (Elements of Remote Sensing and Geomorphology)

Unit I:


Unit II:

Recognition elements in the study of aerial photos- tone, texture, pattern, shape, size, form, shadow, drainage, vegetation, and landforms. Photographic expressions of various geological features on aerial photos and factors affecting such expressions (climate, vegetal cover, soil, type of weathering vis-à-vis nature and composition of rocks). Importance of concept of convergence of evidence in photo-interpretation. Guidelines for lithologic, structural and geomorphic interpretation.

Unit III:


Unit IV:

Karst topography, Aeolian and glacial cycles, Concept of morphometric regions, Topography developed over folded and faulted structures. Brief idea about applied geomorphology.
Practical's

Remote Sensing:

Test of stereoscopic vision. Handling of aerial photographs. Aerial photo index. Orientation of stereopairs. Stereoviewing on aerial photos in conjunction with relevant toposheets. Significance of scale and resolution factors. Study of aerial photo expression of structural, geomorphic and lithologic features on stereopairs.

Geomorphology:

Reading of topographic maps. Scheme of numbering of topographic maps. Data provided on topographic maps. Drainage patterns and their relationship to lithology and structure. Computation of gradient of a stream. Contour patterns related to different topographic forms such as valleys, ridges (mesa, cuesta, homoclinal ridge, hogback), scarps, domes, basins, waterfalls, slopes, plains, gorges, plateaus, sand dunes. Contour patterns related to structures such as horizontal, dipping and folded beds, plunging folds. Contour patterns of igneous, sedimentary and metamorphic rock.

Books recommended:

Remote Sensing:

1. Pande: Principles and applications of Photogeology.
2. Sabins: Remote sensing Principles and interpretations.

Geomorphology:
B. Sc. Geology Semester V

DECIPLEN SPECIFIC ELECTIVE

Paper III: (EXPLORATION GEOLOGY)

Unit 1:

Unit 2:

Unit 3:

Unit 4:
Drilling and Logging: Core and non-core drilling. Planning of bore holes and location of boreholes on ground, Core-logging and Reserve estimations and Errors. Principles of reserve estimation, density and bulk density.
PRACTICALS:


Books recommended:


B. Sc. Geology Semester V

DECIPLENE SPECIFIC ELECTIVE:

Paper IV: PÉTROLUM GEOLOGY

Unit-I:
Introduction and Aspects of Petroleum Geology, Characteristics of Hydrocarbons (Physical and Chemical properties), Petroleum System, Composition, Origin (Types of Kerogen), Occurrence, Migration and Accumulation of Petroleum; Petroleum traps (Stratigraphic and Structural); Reservoir rocks, conditions & mechanisms.

Unit-II:
Surface indications and direct detection of Hydrocarbons, Surface and subsurface exploration techniques; Concept Geophysical methods of exploration: Gravity and Seismic methods.

Unit-III:
Geo Logging and Well Logs (Electric, Radioactive and Acoustic); Formation evaluation and Testing Geo Logging and Well Logs (Electric, Radioactive and Acoustic); Formation evaluation and Testing Well Completion and Stimulation An outline of the oil belts of the India; Indian geographic and stratigraphic distributions of oil and gas.

Unit-VI: Recent trends in Petroleum Geology. Recent trends in Petroleum Geology. Functions of Petroleum Geologist; Understanding oil and gas: Exploration, Drilling and Completion; Production, Services Types of rigs and its selection; Rotary drilling system and equipments; Drilling sequence: Coring; Casing and Cementation and Drilling fluids;
Practical:

Plotting of Petroliferous basins on maps, India. Important Onshore and Offshore Petroliferous basins of India. Problems based on Well log interpretation, Creation of isopachous maps.

Books recommended

B. Sc. Geology Semester V

SKILL ENHANCEMENT COURSE

Paper I: (Elements of Applied Geology)

Unit-I: Engineering properties of rocks and Soils.

Unit-II: Soil and Soil groups of India.

Unit-III: Elementary idea of mining and Environmental considerations for mining.

Unit-IV: Mineral exploration; Elementary idea of geological prospecting.

Practicals: Surveying by Plane Table/Theodolite; Preparation of geological maps; Engineering properties and identification of building stones.

Books Recommended:


Unit-I: Introduction and Principle of geochemistry, Chemical composition and properties of atmosphere, hydrosphere and lithosphere. Elementary idea of Periodic Table: Major, Minor, trace and Rare elements.

Unit-II: Cosmic abundance of elements; Composition of the planets and meteorites; Geochemical evolution of the earth and geochemical cycle.

Unit-III: Geochemical classification of elements; Distribution of major, minor and trace elements in igneous, metamorphic and sedimentary rocks.

Unit-IV: Elements of geochemical thermodynamics; Isomorphism, polymorphism and Pseudomorphism; Isotope geochemistry.

Practicals

Determination of LOI of rock samples, Preparation of variation diagrams and plotting of REE data

Books Recommended:


B.Sc.-III Year
SEMESTER – VI
Geology
B. Sc. Geology Semester VI

DECIPLENE SPECIFIC ELECTIVE

Paper I: (Structural Geology)

Unit I:

Unit II

Unit III

Unit IV

Practicals:
Structural Geology: Reading a geological map and the symbols used. Completion of outcrop/counter maps, problems based on true dip and apparent dip, three point problems, and determination of thickness and depth of the beds. Drawing of geological and interpretation of geology and geological history.
Books recommended:


5. Park: Fundamentals of Structural Geology.


10. Lahi: Field Geology.


16. Bolton: Geological Maps: Their solution and interpretation
B. Sc. Geology Semester VI

DECIPLINE SPECIFIC ELECTIVE

Paper II: (Elementary Hydrogeology and Environmental Geology)

Unit I


Unit II

Hydrologic properties of rocks. Hydrogeologic characteristics of different types of rocks. Aquifers and their classification. Groundwater provinces of India. Groundwater conditions in different parts of Maharashtra. Concept of watershed management.

Unit III

Definition and concept of Environmental Geology. Natural hazards such as earthquakes, landslides, floods, volcanic activity, coastal erosion, desertification and their impact on environment. Soil types, soil degradation and mitigation, soil pollution.

Unit IV

Concepts of natural ecosystems on the earth and their mutual interrelations and interactions (atmosphere, hydrosphere, lithosphere and biosphere). Environmental changes due to human dominated environment over nature dominated system. Environmental considerations in the constructions of large dams, reservoirs, and tunnels. Pollution: its effect on natural ecosystem and anti-pollutional measures (water and air)
Practical

**Hydrogeology:** Determination of groundwater flow direction. Interpretation of well inventory data. Pumping test: time-drawdown and time recovery test and evaluation of aquifer parameter in nearby area.

**Environmental Geology:**

Preparation of map of seismic zone, volcanic hazards zone, flood prone zone and land slide zones of India.

Books recommended: Hydrogeology:

1. Todd: Ground water Hydrology
2. Karanth: Hydrogeology
3. Nagabhushaniah : Groundwater in Hydrosphere (Groundwater hydrology)
4. Karanth: Groundwater Assessment, Development and Management

**Environmental Geology:**

1. Valdiya: Environmental Geology
2. Miller: Sustaining the Earth
3. Foley, Duncan, McKenzie and Utgard: Investigations in Environmental Geology
4. Keller : Environmental Geology
5. Bell: Geological Hazards.
6. Coats: Environmental Geology
B. Sc. Geology Semester VI

DECIPLENEN SPECIFIC ELECTIVE

Paper III: (SURVEYING and MAPPING)

Unit I

Instrument used in geological mapping and survey. Principle of surveying method, recording, reading and plotting by Prismatic compass, Brunton compass, theodolite and plane table.

Unit II

Leveling and contouring by Hand level, Abney and Dumpy level. Methods of Leveling: Spot, Differential and profile leveling.

Unit III

Fundamental of mine survey, Survey in opencast and underground mines, Geological mapping in opencast and underground mines,

Unit IV

Type of geological map and Skill Enhancement Exercises. General principle of geological mapping, mapping method in Igneous, sedimentary and metamorphic terrain. Toposheet Indexing scheme, Map symbol reading, SOI toposheet map reading Standard Symbols/colour for lithology and symbols.
Practical

The evaluation is to be based on preparation of portfolio that should include plans drawn using Plane table, a Leveling Exercise.

Books recommended:

B. Sc. Geology Semester VI

DECIPLINE SPECIFIC ELECTIVE

Paper III: (Marine Geology and Oceanography)

Unit I:
History of development of marine geology; Origin of ocean basins; A brief account of tectonic history of the oceans; Oceanic crust; Deep ocean-floor topography; Morphology of ocean margins; Marine sediments, sources and composition, sediment types and distribution; Oceanic sediments and microfossils; Deep sea sediments and their relation to oceanic processes such as productivity, solution and dilution.

Unit II:
Oceanic circulation - Surface, intermediate and deep ocean circulation; Forces that produce and effect circulation patterns in world oceans; Important phenomena associated with surface circulation; Formation and movement of deep and bottom waters; Sedimentation rates; Calcite and aragonite compensation depth.

Unit III
Methods and instruments for exploring the ocean floor; Deep Sea Drilling Project (DSDP), Ocean Drilling Programme (ODP) and Joint Global Flux Studies (JGOFs) and their major accomplishments; Integrated Ocean Drilling Programme (IODP) and its aims and objectives; Sediment distribution in time and space as related to tectonic models;

Unit IV:
Evolution of oceans through the Cenozoic; Ocean gateways and their role in controlling global climates; Sea level changes during Quaternary with special reference to India; Reconstructing Quaternary climatic and oceanographic history on shorter time scales using marine records; Mineral resources of the ocean including polymetallic nodules;
Practical:
Sedimentary facies; Bio facies; Depth biotopes and estimation of paleodepth of the ocean using benthic foraminiferal assemblages; Identification of modern and ancient surface water mass with the help of planktic foraminiferal assemblages; Identification of benthic foraminifera characteristic of Low oxygen environment; Identification of planktic foraminifera characteristic of warm and mixed layer.

Books Recommended:

Field work:
Field work shall be treated as a part of practical examination of semester VI and Marks are assigned on it. Every student should attend field work for a short duration and submit field diary, geological specimen and a report. Field report shall be assessed by teacher and Head of the Department.
B. Sc. Geology Semester VI

SKILL ENHANCEMENT COURSE

Paper I: (Urban Geology)

Unit 1:
Geology and Society Necessity of Geology in Urban life. Geology in Urban Constructions Geotechnical feature and mapping for subsurface in Metropolitan areas Building materials, Excavation and cutting in urban areas.

Unit 2:
Geology and Urban Agriculture Soil studies, Chemistry and geochemistry of soil in relation to ground water and fertilizer Effect of pollutants on vegetable contamination

Unit 3:
Urban land use Geotechnical site characterization, Geotechnical and land use mapping, Decision making in urban landuse, Geological problems in construction of underground structures in urban areas Urban Tunneling: Tunneling for road and rail in urban areas, Method, Equipments, Importance of Geology

Unit 4:
Urban water Water lagging in built-up areas, Source of water, Standards for various uses of water Sources of contamination Waste waters: Sources and its disinfection and treatment, Ground water surveys and resource development.

PRACTICALS:
1. Map Reading
2. Ground water flow direction estimation
3. Case studies of Urban flood; Flood hydrographs
4. Case studies of urban planning

Books Recommended:
2. Lollino, G. et al. (Ed.), Engineering Geology for Society and Territory. Springer
B. Sc. Geology Semester VI

SKILL ENHANCEMENT COURSE

Paper II: (EARTH RESOURCES)

Unit 1:
Earth Resources reserve definitions; mineral, energy and water resources in industries. Historical perspective and present. A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies.

Unit 2:

Unit 3:

Unit 4:
PRACTICALS:

1. Plotting of major Indian oil fields on map of India
2. Problems related to assessment of possible oil exploration site from geological maps
4. Problems related to energy demand projection of India and possible mitigation pathways
5. Problems related to biofuel

Books Recommended: