

Programme Outcomes, Programme Specific Outcomes and Course Outcomes For PG Programmes

Programme Name: M.SC in Applied Geology

(e.g M.Sc in Physics/ MA in Bengali/MCA etc.)

Number of Semesters: 4



Department of Geology
University of North Bengal
West Bengal, INDIA

Programme Outcomes

- Development of critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.
- The students trained to analyze problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.
- Promote students for pursuing research or careers in industry in earth sciences and allied fields
- Development of effective scientific and/or technical communication in both oral and writing.
- Encourage to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in geological sciences.
- Ensure being an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

Programme Specific Outcomes

- Understanding of the fundamental laws in earth sciences and capability of developing ideas based on them.
- Prepare and motivate students for research studies in earth sciences and related subjects.
- Develop ample knowledge of a wide range of geological techniques and application of geological methods/principles in other interdisciplinary domains.
- Provide advanced knowledge on topics in various branches of geology, empowering the students to pursue higher degrees at reputed academic institutions.
- Advance understanding of earth's surface and subsurface processes which can be used in solving modern earth science puzzles.
- Nurture problem solving skills, thinking, creativity through assignments, project work.
- Assist students in preparing (personal guidance, literatures) for competitive exams e.g. NET, GATE, etc.

Course Outcomes

SEMESTER—I		
Course Code	Course Name	Course Outcomes
GEOL/101	Mineralogy and Geochemistry	<ul style="list-style-type: none">• Basic knowledge on crystal structures and bonding and laws• Silicate structures and their physical and chemical properties• Bragg's law, application of X-ray technique in identification of minerals through crystal structures

		<ul style="list-style-type: none"> • Cosmic abundance of elements, comparison of composition of earth with other planets and meteorites • Isotope geochemistry, geochronology, role of Eh-pH in natural systems • Earth-ocean-atmospheric interaction
GEOL/102	Structural geology	<ul style="list-style-type: none"> • Rheological behavior of rocks • Deformation mechanism, calculation of stress • Measurement of strains, elastic and plastic deformation • Classification, origin, mechanisms of folds, faults shear zones
GEOL/103	Sedimentology	<ul style="list-style-type: none"> • Process-product relationship • Sedimentary facies – palaeoenvironmental and palaeogeographic reconstruction • Tectonics and sedimentation • Application of Trace element, rare earth element and isotope geochemistry for sedimentological and palaeoclimatic problems
GEOL/104	Palaeontology	<ul style="list-style-type: none"> • Origin of life, Precambrian life, evolution of life • Numerical taxonomy, Cladistic taxonomy • Mass extinction, rate and evolution • Microfossils and its application in petroleum basins • Palynology: spores and pollen

SEMESTER—II

Course Code	Course Name	Course Outcomes
GEOL/201	Igneous petrology	<ul style="list-style-type: none"> • Magma generation and emplacement, physical properties • Classification, texture and structures in igneous rocks • Thermodynamic and phase rule: phase diagram and application in understanding melt-crystal equilibria
GEOL/202	Metamorphic Petrology	<ul style="list-style-type: none"> • Metamorphic grades, metamorphic facies – concept of P-T path • Metamorphic phase rule in closed and open systems • Composition and paragenesis diagram • Tectonism and metamorphism • Mineralogical geothermobarometry, phase rule • Metamorphism in crustal systems
GEOL/203	Stratigraphy	<ul style="list-style-type: none"> • Archaean cratons – lithology, tectonics and igneous activity • Concept of supercontinent • Proterozoic mobile belts • Proterozoic basins and their evolution • Phanerozoic stratigraphy of india • Boundary problems
GEOL/204	Geotectonics and applied geophysics	<ul style="list-style-type: none"> • Geomagnetic fields, paleomagnetism, polar wander, geomagnetic pole reversal, sea floor spreading • Plate boundaries, plate motion and dynamics • Relative plate motion – geodetic measurement • Seismology, internal structure of the earth • Gravity and gravity anomalies, gravity survey, gravity map preparation • Magnetic fields, magnetic behavior of rocks, magnetic methods – anomalies, preparation of magnetic anomaly maps

		<ul style="list-style-type: none"> • Thermal and electrical properties of rocks, resistivity method • Application of electrical method in groundwater exploration • Seismic method, wave propagation principles, seismic data interpretation
SEMESTER—III		
Course Code	Course Name	Course Outcomes
GEOL/301	Geomorphology and Engineering Geology	<ul style="list-style-type: none"> • Landform: exogenic and endogenic processes • Landform and tectonics • Drainage pattern, sea level change and geomorphic cycle • Concept of geological investigation in engineering projects • Concept of building materials and source • Reservoir and dam: type, stability • Criteria for dam site selection • Tunnels: stability of tunnels, criteria for selecting tunnel site
GEOL/302	Economic geology and fuel geology	<ul style="list-style-type: none"> • Ore forming processes • Tectonics and ore formation • Ore texture and genesis. Phase equilibria of sulphide and oxide • Ore in igneous rocks, metamorphic rocks, sedimentary placer deposits • Indian occurrence of metallic and non-metallic ores • Raw materials used in different industries and their specifications • Source of energy • Origin of coal, macerals – types and composition • Grade and rank of coal, classification, Indian occurrence • Petroleum: physical and chemical properties, origin • Migration and reservoir, traps • Nuclear fuels: mineralogy and geochemistry • Indian distribution of radiogenic minerals • Nuclear waste disposal – geological criteria
GEOL/303	Mineral Exploration, Mineral Beneficiation, Mining Geology	<ul style="list-style-type: none"> • Prospecting and exploration principles • Surface and sub-surface exploration methods • Drilling methods- core and non-core • Geochemical and geobotanical exploration • Mineral economics, strategic minerals • Reserve and resource classification, National Mineral Policy • Beneficiation: scope, importance and advantage • Construction and operation of crushers and crushing • Construction and operation of ball and rod grind mills • Size, specific gravity and surface property dependent beneficiation processes • Methods of mining • Mining hazards: fire and rock blast

		<ul style="list-style-type: none"> • Underground mine mapping • Planning, exploration and exploratory mining • Environmental impact in mining
GEOL/ EL1	Ocean Science	<ul style="list-style-type: none"> • Physical oceanography, coastal processes, wave propagation, reflection and refraction, tsunami • Tides: causes and magnitude • Estuaries: Classification, coastal population, coastal management • Global Wind system; Ekman's theory; Sverdrup, Stommel and Munk's theories • Ocean currents, geostrophic motion; barotropic and baroclinic conditions • El Nino; monsoonal winds and currents: North Indian Ocean; Arabian Sea: Upwelling processes. • Chemical Oceanography: Seawater Composition; Elements: Types, Classification and distribution; Chemistry of Element: pore fluid and anthropogenic inputs • Ionic interactions; nutrients cycle, trace metals and organic matter. Atmosphere-Ocean Interaction: biological pump • Biological Oceanography: Marine environment and marine organisms; Production of marine life • Abundance and diversity; coastal communities; Ecology and community: food webs • Anthropogenic impacts on marine biota; climate change and marine biodiversity • Pollution and marine environments including fisheries
GEOL/ EL2	Climatology and Environmental Geology	<ul style="list-style-type: none"> • Climate: Classification; Koppen's and Thornthwaite's classification • Composition and structure of the atmosphere • Energy Balance: Solar Radiation; Temperature and Moisture; Distribution of temperature. • Monsoons and Jet Streams; Cyclones: temperate and tropical • Precipitation: types and distribution • Global warming and climate change • Past and present climate • Fundamental concept of environmental geology, problems and issues • Pollution: air water and land • Solid and nuclear waste • Global climate change and deforestation • Disaster management, concept of environmental impact assessment (EIA)
SEMESTER—IV		

Course Code	Course Name	Course Outcomes
GEOL/401	Remote sensing and hydrogeology	<ul style="list-style-type: none"> • Basic concept of remote sensing • Photogeology: digital and conventional • Electromagnetic radiation: concept and theories, interaction with atmosphere and application of remote sensing • Remote sensing data: source and sensors • Data acquisition, satellite imagery • Aerial photography: types and interpretation • GIS and GPS • Hydrological cycle, Aquifer; flow rates and flow directions • Groundwater fluctuation: types, controlling factors • Groundwater wells, types and methods • Groundwater chemistry: Components of groundwater; Salinity in Groundwater • Seawater intrusion and Ghyben-Herzberg Relation • Classification and Indian salinity hazards • Artificial recharge of groundwater • Groundwater Exploration: Surface geophysical methods • Groundwater Management and Development • Groundwater pollution: Arsenic, fluoride and Nitrate
GEOL/EL3	Sedimentary basin analysis	<ul style="list-style-type: none"> • Mechanism of basin formation, basin formation and plate tectonics • Palaeocurrent analysis: methods and application • Sediment routing system; Erosion and regolith; Terrestrial sediment and solute yield • BQART equation; Chemical weathering and global biogeochemical cycles; measurement of erosion rate • Basin stratigraphy: Accommodation, sediment supply and sea level • Stratigraphic cycles: definition and recognition; • Subsidence history and backstripping; Signatures of Tectonic subsidence • Measurements of thermal maturity in sedimentary basins • Application to petroleum Geology
GEOL/EL4	Isotope Geology	<ul style="list-style-type: none"> • General characteristics of Isotopes, Isotope effects, Isotope fractionation process • Mass Spectrometry: Basic principles; Equations of motion of ions; Ion Microprobe and Electrostatic Tandem Accelerators; Isotope Dilution Analysis

		<ul style="list-style-type: none"> • Radioactivity, Decay mechanism of radioactive atoms; Radioactive decay and growth, Radiogenic isotope in Geochronology and Petrogenesis, Fission-track dating • Stable isotope geochemistry: Variations of Stable Isotope ratios • Isotope Geothermometry, Isotope Fractionation in the Hydrologic and Biological System
GEOL/ EL5	Quaternary Geology	<ul style="list-style-type: none"> • Definition and scope of Quaternary Geology • Evolution of landscape and interactions between tectonic, climatic, and geomorphic processes • Radiogenic Carbon and Optical stimulated luminescence (OSL) radiogenic dating method • Dendrochronology; Tephrochronology, Climatostratigraphy, Magnetostratigraphy • Global climate pattern, Climate controlling factors and Milankovitch Hypothesis, Quaternary Environments, Quaternary Sea-level changes • Fossil records of the Quaternary; Pollen analysis, Mammalian fauna • Paleoclimatic reconstruction; Effect of Anthropogenic activity on Global climate