## M.Sc. in Applied Geology

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<th>Course Code</th>
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<tr>
<td>EAS C301</td>
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<tr>
<td>EAS C303</td>
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<td>Stratigraphy of India</td>
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<td>Recent Trends in Paleontology</td>
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<td>Applied Remote Sensing and GIS</td>
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<td>Structural Geology and Geotectonics Practical</td>
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<td>Petrology Practical</td>
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<td>Exploration Geophysics</td>
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<td>Applied Hydrogeology</td>
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<td>Geophysics and Applied Hydrogeology Practical</td>
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**Objective:** Our planet is full of mysteries, wonder, contradictions, and beauty. As citizens of this planet, it is our responsibility to understand what makes the Earth. This course will help you develop an understanding of the processes that shape our planet and will hopefully give you a renewed appreciation for our natural wonders. You will learn about issues that will affect us all in times to come, including geologic hazards, global warming, and planetary exploration.

**Unit 1:** Landform evolution: Basic geomorphic concepts of landform evolution; Exogenic processes – Weathering and geologic controls in weathering, mechanical weathering and products; Chemical weathering processes and products; Weathering and landform alteration. Soil formation and types; Soil profile, horizons and soil types.

**Unit 2:** Physical Geology – History of the Universe and Solar System – Geologic time and the evolution of the planet over 4.6 billion years - The dynamic earth, changing continental surfaces, Materials of the Earth's crust, surface features, earth's internal structure, plate tectonics, geologic structures, the rock cycle, and surface/subsurface processes.

**Unit 3:** Fluvial system and processes – Drainage basin, basin and stream characteristics, drainage types and patterns, erosion, transportation and deposition by running water, erosional landforms, depositional landforms; Fluvial landforms in arid areas - eolian processes – erosion by wind and erosional landforms, depositional landforms such as sand dunes and loess, types of dunes and mechanics of dune formation; Glacial processes, types of glaciers and glacial landforms.

**Unit 4:** Endogenetic landforms – Internal heat source, concept of plate tectonics and evolution of landforms, earthquakes and related landscape alterations, volcanic landforms, mountain building, rift valley formations; oceanic landforms.
Unit 5: Coastal geomorphic processes—Classification of coasts; Wave formation and wave dynamics, tides and tide formation; Erosional landforms, depositional landforms, estuaries and lagoons. Geomorphology of India.

Selected Text Books and Reference Books:


| EAS C 302 | Mineralogy and Instrumentation Techniques | C 3 1 0 4 | Dr. N. Rajeshwara Rao |

Objective: Understanding the concepts of Mineralogy is essential to comprehend the concepts of Petrology. With a fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject. The main objective of this course is to inculcate the fundamental aspects of Mineralogy in such a way as to stimulate the minds of the postgraduate students.

Unit 1: Introduction to crystallography – Crystal systems – Symmetry elements – Isometric, Tetragonal, Orthorhombic, Hexagonal, Monoclinic and Triclinic systems – Normal classes.


Unit 3: Description and composition of the following mineral groups: Quartz, Feldspars, Feldspathoids, Micas, Garnets, Olivine, Pyroxenes, Amphiboles, Zeolites and Carbonate minerals.


Selected Text Books and Reference Books:


<table>
<thead>
<tr>
<th>EAS C 303</th>
<th>Mineralogy and Paleontology Practical</th>
<th>C</th>
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<th>4</th>
<th>Dr. N. Rajeshwara Rao and Guest faculty</th>
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**Palaeontology:** Identification of important fossils belonging to mollusks, brachiopods, trilobites and graptolites – Plant fossils – Identification of common species of foraminifera and ostracods.

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<th>EAS E 301</th>
<th>Environmental Earth Science</th>
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<th>Dr. N. Rajeshwara Rao</th>
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**Objective:** To provide knowledge on various types of environment, their contamination and remedial measures to be taken as an individual and a group.
Unit 1: Concept of environment – Environmental monitoring – Water as a resource, Water pollution – Point and non-point pollution sources – Ground water pollution.

Unit 2: Air pollution – Natural and anthropogenic sources of air pollution – Primary and secondary air pollutants – Anthropogenic activities and air pollution – Indoor air quality – Biological sources of indoor pollution – Health effects – Air quality standards – Case histories – Air quality monitoring – Acid rain – Adverse effects of acid rain – Health effects – Mitigation measures – Roles and responsibilities.


Unit 5: Medical geology – Problems associated with fluoride, arsenic, asbestos, mercury, chromium, cadmium, zinc, copper and lead contamination – Alternate energy resources – Climate change.

Selected Text Books and Reference Books:


| EAS E 302 | Stratigraphy of India | E | 3 | 0 | 0 | 3 | Guest Faculty |

**Unit 1:** Principles of Stratigraphy – Stratigraphic classification and nomenclature – Concept of rock Units- Time units and Time – rock Units – Lithostratigraphic Units – Biostratigraphic Units – Chronostratigraphic Units – Geologic time Units – Correlation – Physical and Paleontologic evidences – Homotaxis.


**Unit 3:** Indian stratigraphy: Physiographic subdivisions, structures and tectonic history of the Indian subcontinent. Study of the various geological formations of Precambrian, Paleozoic, Mesozoic, Tertiary and Quaternary Eras: distribution, geological succession, classification, correlation.


**Selected Text Books and Reference Books:**

York.

6. Wadia, D.N., Geology of India.

**EAS E 303 Recent Trends in Paleontology**

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<th>E</th>
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**Unit 3:** Vertebrate paleontology: Succession of vertebrate life through geologic time. Broad classification and study of some characteristic Indian vertebrate genera. Indian pre-Tertiary vertebrate - their distribution and paleogeographic implication; extinction of dinosaurs. Indian Tertiary vertebrate - Siwalik mammals; phylogeny - Equidae & Proboscidae. Indian fossil Hominoides and modern theories regarding human evolution.

**Unit 4:** Invertebrate paleontology: an overview. Morphology, classification, evolutionary trend, composition and structure of shells of selected groups of organisms - Porifera, Bryozoa, Mollusca, Brachiopoda. Geological history, geographical distribution and description of more important genera of Trilobita, Echinoides, Coelenterata and Graptoloidea.

**Unit 5:** Micropaleontology: Sampling methods and sample processing techniques. Types of microfossils. Calcareous Microfossils - Foraminifera - major morphologic groups; Benthic Foraminifera; depth biotopes, value in paleobathymetric determination. Larger foraminifera – their utility in Indian stratigraphy. Planktonic foraminifera and calcareous nannofossils. Ostracoda - outline morphology, paleoecology & geological history. Brief knowledge about pteropods, calpionellids and calcareous algae.
Selected Text Books and Reference Books:

7. Hecker, R.R. – Introduction to palaeoecology

1. Prothero, D.R. – Bringing fossils to life-An introduction to palaeobiology

II – SEMESTER


UNIT 2: Techniques of strain analysis – Particle paths and flow patterns – Progressive strain history and methods for its determination. Deformation mechanisms – Role of fluids in deformation processes – Geometry and analysis of brittle-ductile and ductile shear zones –


**Unit 4:** Major tectonic features and associated structures in extensional-, compressional-, and strike-slip terrains – Joints and unconformities – Penecontemporaneous deformational structures of sedimentary rocks. Plate tectonics – Concept and principles – Continental drift – Geological and geophysical evidences – Mechanics, objections and present status of plate tectonics.

**Unit 5:** Gravity and magnetic anomalies at mid-oceanic ridges, deep sea trenches, continental shield areas and mountain chains – Geological and geophysical characteristics of plate boundaries – Geodynamic evolution of the Himalayas – Paleomagnetism – Sea floor spreading and plate tectonics – Island arcs, oceanic islands and volcanic arcs – Isostasy, orogeny and epeirogeny – Geodynamic of the Indian Plate.

**Selected Text Books and Reference Books:**


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**EAS C 305 Applied Remote Sensing and GIS C 3 1 0 4 Dr. R. R. Krishnamurthy**

**Objective**: To provide in depth knowledge and exposure to Remote Sensing and GIS technology tools with particular reference to land and ocean applications.


**Unit 3**: Image processing in remote sensing: Digital data recording – Digital data format. Introduction to digital image processing – Pre-processing techniques – Image classification methods – Image enhancement techniques.

**Unit 4**: Applications of remote sensing: Visual interpretation – Different sensors – Data and image interpretation key elements. Exercises on mapping of geology – Land use/land cover and geomorphology based on visual method – Preparation of base maps and transformation of thematic maps. Validation of remote sensing analysis output by ground truth – Accuracy, estimation and introduction to GPS technology.

**Unit 5**: Fundamentals and application of GIS: Concept of GIS – GIS types – Data storage – Retrieval and analysis. GIS database organization and development – Combined use of remote
sensing and GIS. Preparation of spatial decision support system (SDSS). Highlights on different applications using GIS tool with particular reference to Applied Geosciences and Ocean Science.

**Selected Text Books and Reference Books:**


| EAS C 306 | Field Mapping | C | 0 | 2 | 4 | All Faculty |

**Objective:** To impart field knowledge with regard to disposition of rocks, minerals, ores and other geological processes including coastal landforms.
Unit 1: Use of clinometer compass for geographic directions, taking bearing and back bearing, strike and dip, reading of and locating oneself on toposheet – Use of GPS for co-ordinates and mapping of features (One day) – Geomorphological mapping (One day).

Unit 2: Visit to igneous rock outcrops for mapping, collection of rock samples and field set-up studies (Two days) – Mapping of dikes and veins – Thin section studies of rocks (One day).

Unit 3: Visit to sedimentary terrain for mapping of strata and collection of fossils (Two days).

Unit 4: Visit to metamorphic terrain for mapping of rocks and metamorphic structures, collection of rock samples (Two days) – Thin section studies (One day).

Unit 5: Geophysical investigations – Field measurements using gravity, magnetic and electrical methods (Two days).

EAS C 307 Structural Geology and Geotectonics Practical C 4 0 0 4 Dr. S.G.D. Sridhar


Selected Text books and Reference books:


| EAS C 308 Petrology Practical | C 4 0 0 4 | Dr. N. Rajeshwara Rao & Guest Faculty |

**Unit 1:** Megascopic and microscopic study (textural and mineralogical) of the following igneous rocks: Granite, Syenite, Gabbro, Basalt, Peridotite, Pyroxenite, Dunite. Lamprophyres, Dolerite, Phonolite, Rhyolite, Trachyte, Andesite, Pitchstone, Anorthosite, Aplite, Pegmatite. Introduction to modal analyses of Granite, Basalt and Gabbro.

**Unit 2:** Megascopic and microscopic study (textural and mineralogical) of the following metamorphic rocks: Low grade metamorphic rocks: serpentinites, albite-epidote-chlorite-quartz schist, slate, talc-tremolite-calcite-quartz schist. Medium to high grade metamorphic rocks: Gneisses, amphibolite, hornfels, garnetiferous schists, sillimanite-kyanite-bearing rocks, Granulites, eclogite, diopside-forsterite marble. Laboratory exercises in graphic plots for petrochemistry and interpretation of paragenetic diagrams.

**Unit 3:** Megascopic and microscopic study (textural and mineralogical) of the following Sedimentary rocks: Sand stone, Lime stone, Conglomerate, Arkose, mud rocks.

**Unit 4:** Harker’s, Larsen’s variation diagrams – Peacock’s Alkali-Lime Index – Niggli’s variation diagram – Preparation of Thin section. 10.

**Selected Text books and Reference books:**


| EAS E 304 Applied Petrology | E 3 0 0 3 | Dr. N. Rajeshwara Rao & Guest Faculty |

**Unit 1:** Forms, textures and structures of igneous rocks. Petrology and geotectonic evolution of granites, basalts, andesites and alkaline rocks. Petrology of gabbros, kimberlites, anorthosites and carbonatites. Origin of primary basic magmas. Classification of igneous rocks. Nature of Magmas –
Generation of magmas. Factors affecting their evolution and their relation to plate tectonics—Magmatic differentiation and Assimilation. Variation diagrams


Unit 5: Sedimentary environments and facies, Continental alluvial – fluvial, lacustrine, desert – Eolian and Glacial sedimentary systems; Shallow Coastal Facies, Marine and Continental Evaporates; Shallow water Carbonates; Deep sea basins; Volcanoclasts Petrography of rocks of Clastic, Chemical and Biochemical origin, Clastic Petrofacies, Paleoclimate and Paleoenvironment analyses; Application of trace elements, Rare-earth elements and Stable isotope geochemistry to sedimentological problems.

Selected Text books and Reference books:

10. William, Turner and Gilbert., 1965, Petrography, UFS, Bombay

<table>
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<tr>
<th>UOM S 002</th>
<th>Soft Skill -2</th>
<th>S 2 0 0 2</th>
<th>University of Madras</th>
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III – SEMESTER

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<tr>
<th>EAS C 309</th>
<th>Exploration Geophysics</th>
<th>C 3 1 0 4</th>
<th>Dr. R. R. Krishnamurthy &amp; Guest Faculty</th>
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**Objective:** To provide a comprehensive background on the principles of various geophysical exploration techniques used for exploring hidden ore minerals, oil and natural gas resources, their relative advantages and disadvantages.

**Unit 1:** Introduction – Physical basis of geophysical exploration, various surface and sub-surface methods and their classification. Physical properties of rocks and minerals exploited in exploration and factors that control them. Geophysical anomaly, Radioactivity of rocks and ores, radioactive minerals and ores. Radiation measuring devices – Ionization chambers, gas filled (Geiger Müller) counters, scintillation counters, radiometers and γ ray spectrometers. Field radiometric methods – Air-borne surveys, automobile surveys, foot surveys. Processing and interpretation of field data. Application of radiometric methods.

**Unit 2:** Gravity Prospecting: Gravity prospecting – Principles, the Earth’s gravitational field and units, its variation, Newton’s Law – Geoid, spheroid and normal gravity field, figure of earth. Order of anomalies produced by geological discontinuities, absolute and relative measurement of gravity, gravimeters and their operation in the field. Field procedure, reduction and correction of gravity field data, separation of regional and residuals, upward and downward
continuation, interpretation of gravity data obtained over spherical and cylindrical objects, sheet, dike and faults – Applications of gravity methods.

**Unit 3**: Magnetic prospecting – Definitions, basic theory, magnetic field, main field, external field and local anomalies, rock susceptibilities, natural remnant magnetism and paleomagnetism, principles of magnetic prospecting, magnetic elements and magnetic anomalies. Magnetometers – Proton precession magnetometer – Field procedure for ground magnetic surveys, smoothening of data, interpretation of data, qualitative and quantitative interpretation of field data over simple geometrical structures – Applications of magnetic prospecting methods. Radiometric prospecting – Fundamentals of radioactivity, rate of radioactive decay, successive disintegration and radioactive equilibrium, natural radioactive elements, radioactive series. Nature of radioactive emission – α, β particles and γ rays, artificial radioactivity.

**Unit 4**: Electrical methods – Electrical properties of earth materials – Conduction in rocks, conduction in water-bearing rocks, description of geoelectric sections, classification of electrical methods. Resistivity method – Ohm’s Law, resistivity, factors affecting resistivity, effect of homogenous earth, various configuration for resistivity methods, configuration factor, response over a layered earth. AC and DC type resistivity meters, field procedure for electrical profiling and sounding, logarithmic curve matching, advantages of plotting the data on a logarithmic graph paper. Interpretation of profiling and sounding field data, use of modelling in electrical methods, introduction to self-potential, induced polarization methods .


**Selected Text Books and Reference Books**:


| EAS C 310 | Applied Hydrogeology | C 4 | O 0 | O 4 | Dr. S.G.D. Sridhar |

**Objective**: To provide a sound knowledge in ground water geology.

**Unit 1**: Scope and application of geohydrology – Ground water and hydrologic cycle – Components such as precipitation, evapotranspiration, infiltration, surface runoff and subsurface distribution and movement of ground water and their estimation for the purpose of assessing water availability – Lithological, stratigraphical and structural controls in occurrence and movement of ground water - Water-bearing properties of rock formations

**Unit 2**: Porosity, permeability, compressibility of rocks, specific yield, hydraulic conductivity and storativity. Darcy’s experiment, fluid pressure and hydraulic head – Barometric and tidal

Unit 3: Well hydraulics – Cone of depression, radius of influence, drawdown and specific capacity – Theim’s-, Theis-, Hantush- and Newman’s equations for various types of ground water flow conditions – Partial penetration and multiple well pumping cases – Flow in bounded aquifers – Tracer tests and slug tests - Water balance studies and ground water budgeting – Ground water levels and water level maps – Safe yield and conjunctive uses – Artificial recharge and methods.


Selected Textbooks and Reference Books:

5. Garg, S.P. *Groundwater and Tube Wells*. Oxford-IBH.

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<tr>
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<td>EAS C 311</td>
<td>Geophysics and Hydrogeology Practical</td>
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**Geophysics**: Computation of gravity response over a sphere – Exercises on drift correction, separation of regional and residual of gravity data – Contouring of gravity data – Calibration of magnetometer – Interpretation of field magnetic data over a dike – Interpretation of seismic refraction data obtained over 2- and 3-layered earth – Computation of configuration constant – Interpretation of vertical electrical sounding data obtained over 2- and 3-layered earth using the S-line, curve matching and auxiliary point chart method – Field demonstration of resistivity, seismic SP and magnetic prospecting techniques.

**Hydrogeology**: Water-bearing properties of rock formations – Porosity, permeability, compressibility of rocks, specific yield, hydraulic conductivity and storativity, and their estimation - Estimation of aquifer parameters by pumping tests – Step drawdown test and estimation of well losses and well efficiency - Graphical presentation of water analyses.

**Selected Textbooks and Reference Books**:


**Objective:** To provide in depth knowledge on the inter-disciplinary nature of natural hazards, the evolution of theories and thoughts in natural hazards, the geophysical causes of natural hazards, human and environmental impacts, and response to natural as well as man-made disasters and issues, mitigation, recovery and challenges in developing countries.

**Unit 1:** General introduction to natural hazards and disasters: Physical and geodynamic characteristics of earthquakes, tsunamis and storm surges, tropical cyclones, monsoonal floods, landslides. Droughts - different types – monitoring and management and wildfires – Worldwide trends in natural catastrophes and occurrence.

**Unit 2:** Global Climate Change: Global warming and environmental change – Threat of sea level changes on global coasts - Impact on natural resources, environment – Social impact of disasters – Gender, food security, poverty and Climate Change Adaptation.

**Unit 3:** Assessment: Hazard-prone areas identification – Application of remote sensing and GIS tools – Hazard mapping – Risk modeling – Risk zonation and case studies.

**Unit 4:** Preparedness: Risk reduction concepts – Pre- and post-disaster comparison and analysis – Understanding the disaster cycle – Stakeholders’ participation and preparation of comprehensive management plans – Community-based disaster risk management – Participatory risk assessment – Coastal regulations – Coastal management in tsunami reconstruction – National and international scenarios.

**Unit 5:** Mitigation and recovery: Inter-relationship between mitigation and recovery – Process for developing hazards mitigation plan, implementation of comprehensive mitigation strategies – Disaster recovery planning – Disaster emergency preparedness and on recovery and reconstruction – Disaster Risk Reduction (DRR) approaches - Early warning systems.

**Selected Text Books and Reference Books:**


2. WBI Natural Disaster Risk Management Program CDs.


9. EU & UN-ISDR Training modules on School Safety, Community Based Coastal Zone Management and Community Based Information System (2008).

| EAS E 306 | Economic Geology | E | 3 | 0 | 0 | 3 | Dr. N. Rajeshwara Rao & Guest Faculty |

**Unit 1:** Indian mineral deposits and mineral economics


**Unit 2:** Ore genesis


**Unit 3:** Mineralogy and geochemistry of radioactive minerals

Origin and Mineralogy and geochemistry of radioactive minerals. Instrumental techniques of detection and measurement of radioactivity. Radioactive methods for prospecting and assaying of mineral deposits. Distribution of radioactive minerals in India. Radioactive methods in
petroleum exploration — well logging techniques. Nuclear waste disposal — geological constraints.

Unit 4: Coal Geology


Unit 5: Petroleum Geology


Selected Text Books and Reference Books:

Objective: To understand the basic principles of Geochemistry and their applications in prospecting for mineral, water, oil and natural gas resources.


Unit 2: Classifications: Goldschmidt’s classification – Geochemical tracers – Cosmic abundance of elements – Patterns of geochemical distribution – Normal background value – Geochemical anomaly – Primary geochemical differentiation of the Earth.

Unit 3: Geochemical cycles: Origin of the oceans and atmosphere - Chemical weathering, major element cycles, and biogeochemical cycles on the modern Earth.

Unit 4: Isotope geochemistry: Radioactive decay schemes and their application to Geochronology and petrogenesis – Stable and short lived isotopes and their application to earth system processes.

Unit 5: Environmental Geochemistry: Major events in atmospheric history (rise of atmospheric O\textsubscript{2}, regulation of the atmospheric CO\textsubscript{2} concentration - Linked changes of climate and the biosphere - The global carbon cycle - Marine Sediments: a record of environmental global history.

Selected Textbooks and Reference Books:


**EAS C 313 Engineering and Mining Geology**

Objective: To train the students in geotechnical investigations and make them understand the various mining methods adopted in addition to estimation of ore reserves.

Unit 1: Engineering geology: Engineering properties of rocks, soft sediments and soils – Geological investigations pertaining to bridges, buildings, dams, highways and airfields – Types of reservoirs – Geological investigations of reservoir sites.


Unit 4: Methods of underground metal mining: Without artificial supports – With artificial supports – Cut and fill methods – Shrinkage stoping – Caving methods.

Unit 5: Coal mining: Longwall advancing – Longwall retreating – Board and Pillar method – Horizon mining.

**Selected Text Books and Reference Books**:


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<tr>
<th>EAS C 314</th>
<th>Engineering Geology, Mining Geology and Geochemistry Practical</th>
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<th>Dr. N. Rajeshwara Rao Dr. M. Jayaprakash and Guest faculty</th>
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| EAS C 315 | Geological Field Tour | C | 0 | 0 | 2 | 2 | All Faculty |
Objective: To have a field knowledge on mining. To acquire knowledge on research.

Field Tour: Visit to one opencast mine and one underground mine. Visit to at least two institutes where the students can acquire knowledge on research.

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<td>EAS E 307</td>
<td>Oceanography</td>
<td>3.00</td>
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<td>Dr. M. Jayaprakash</td>
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Objective: To provide students the basic as well as applied aspects of Oceanography including the linkages between geology and ocean science and technology.


Unit 4: Chemical oceanography: Composition of sea water – Classification of elements based on their distribution – Major and minor constituents – Behavior of elements – Chemical exchanges across interfaces and residence times in sea water – Chemical and biological interactions – Ionic interactions – Cycling and ocean-atmosphere of important biogenic dissolved gases – Carbon
dioxide-carbonate system – Alkalinity and control of pH – Abiotic and biotic controls of trace elements in the oceans – Biological pump and controls on atmospheric composition – Biogeochemical processes in aerobic and anerobic environments – Water column denitrification and emission of greenhouse gases.


**Selected text Books and Reference Books:**

**ELECTIVES OFFERED TO OTHER DEPARTMENT STUDENTS**

**EAS E 308  Remote Sensing and GIS  E  3  0  0  3  Dr. R.R. Krishnamurthy**

**Objective:** To provide an exposure to Remote Sensing and GIS technology tools with particular reference to geological applications.

**Unit 1:** Aerial photography: Introduction – Vertical and oblique photographs – Aerial photographic procedures – Camera and flight requirement – Flight planning – Filters – Compensation – Stereoscopy – Photomosaics. Photographical studies – Photo recognition elements and keys – Interpretation of lithology, structures and landforms from aerial photographs.


**Unit 3:** Image processing in remote sensing: Digital data recording – Digital data format. Introduction to digital image processing – Pre-processing techniques – Image classification methods – Image enhancement techniques.

**Unit 4:** Applications of remote sensing: Visual interpretation – Different sensors – Data and image interpretation key elements – preparation of thematic maps.

**Unit 5:** Fundamentals and application of GIS: Concept of GIS – GIS types – Data storage – Retrieval and analysis. GIS database organization and development – Combined use of remote sensing and GIS - Preparation of spatial decision support system (SDSS) - Introduction to GPS technology

**Selected Text Books and Reference Books :**


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**EAS E 309  Climatology**  

**Objective:** To provide knowledge on atmosphere and its relation to Geology and climate.


causes of floods – Climatic causes of floods – Runoff forecasting – Snow surveying – Water resources management.

**Unit 4:** Climate and the Biosphere: Climatic factors in plant growth – World patterns of vegetation – Vertical differentiation of vegetation – Climate and forestry – Forest-fire weather – Climate as a factor in soil formation – Spatial patterns of soils – Climate and soil erosion – Marine life – Effects of winds and currents on fisheries.

**Unit 5:** Climate and Housing: Climatic aspects of site – Climate conditioning – Building orientation – Climate conditioning through design – Airconditioning – Heating – Cooling. Modification of Weather and Climate: Modifying climate – City climates – Inadvertent modification of Macroclimates – Planned modification – Cloud modification – Modification of storms – Fog dispersal – Implications of Weather and Climate modification.

**Selected Text Books and Reference Books:**

**Objective**: To provide knowledge on various types of environment, their contamination and remedial measures to be taken as an individual and a group.

**Unit 1**: Concept of environment – Environmental monitoring – Water as a resource – Types of aquifer – Problems associated with over withdrawal of ground water – Effects of urbanization and industrialization on ground water resources.


**Unit 5**: Medical geology – Problems associated with fluoride, arsenic, asbestos, mercury, chromium, cadmium, zinc, copper and lead contamination – Alternate energy resources – Climate change.

**Selected Text Books and Reference Books**:


**EAS E 311 Geological Oceanography**

**Objective:** To provide students the basic as well as applied aspects of Oceanography including the linkages between applied geology and ocean science and technology.

**Unit 1:** Concept of Oceanography: Origin of continents – Ocean basin-Islands – Trenches – Lagoons -Reefs and geosynclines - Continental shelves, slope, Margin, abyssal: their structure and topography-Geological time scale - Historical development of marine geology, global tectonics and sea floor spreading-Ocean floor morphology -Submarine canyons - Submarine volcanism – Near shore geological processes – Sea level changes with special mention to Quaternary.

**Unit 2:** Contemporary processes in the coastal zone: Sedimentation – origin - Physical properties of sediments - Classification of marine sediments: Lithogenous, biogenous, chemogenous and cosmoogenous -Distribution and transport of sediment – Determination of age of sediments - Sedimentary environments and their classification - Geological samplers: Grabs, snappers, corers, box corer, boomerangs, submersibles, vibrocoring and rock drills.

Unit 4: Chemical oceanography: Composition of sea water – Classification of elements based on their distribution – Major and minor constituents – Behavior of elements – Chemical exchanges across interfaces and residence times in sea water – Chemical and biological interactions – Ionic interactions – Cycling and ocean-atmosphere of important biogenic dissolved gases – Carbon dioxide-carbonate system – Alkalinity and control of pH – Abiotic and biotic controls of trace elements in the oceans – Biological pump and controls on atmospheric composition – Biogeochemical processes in aerobic and anerobic environments – Water column denitrification and emission of greenhouse gases.


Selected text Books and Reference Books: