DEPARTMENT OF GEOLOGY
ANNA UNIVERSITY, CHENNAI

MISSION
Committed to provide quality education and research programmes that benefit the students, state and country and prepare them to understand and manage the Earth and its resources for the future.

VISION
- To lead in providing quality education and research programmes in Geology;
- To motivate our students to be productive and responsive scientists and engineers in the society
1. **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

   PEO1 Imparting geological knowledge and skills to gain employment in Industry, Science and research organizations and service sectors.

   PEO2 Produce quality manpower in geology that can elevate and lead the organization effectively.

   PEO3 Enable the students to understand and bring solutions to societal problems related to Geology.

   PEO4 Motivate students to pursue higher studies and research in Geology.

   PEO5 Create an environment to augment entrepreneurial skills that will innovate and market geology related products.

2. **PROGRAMME OUTCOMES (POs):**

   After going through the two years of study, our Post Graduates of Applied Geology will exhibitability to:

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<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
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<tr>
<td>PO1</td>
<td>Scientific knowledge</td>
<td>Applying the knowledge of Geology and its allied sciences to Geo-resource inventory and Natural Disaster management.</td>
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<tr>
<td>PO2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve Geological and technical problems.</td>
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<tr>
<td>PO3</td>
<td>Conceptualize/develop solutions</td>
<td>Conceive and develop solutions to societal problems related to geological processes and to understand their origin and nature.</td>
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<tr>
<td>PO4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret Geological data.</td>
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<tr>
<td>PO5</td>
<td>Modern tool usage</td>
<td>Apply various mapping tools and techniques, usage of geological, geophysical and geochemical equipment to improve the understanding of the earth system science.</td>
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<tr>
<td>PO6</td>
<td>The Geologists and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<td>PO7</td>
<td>Environment and sustainability</td>
<td>Develop policies with environment consciousness that can provide sustainable development.</td>
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<td>PO8</td>
<td>Ethics</td>
<td>Interact in industry, business and society in a professional and ethical manner.</td>
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<td>PO9</td>
<td>Individual and team work</td>
<td>Function in a multidisciplinary team.</td>
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### PROGRAM SPECIFIC OUTCOMES (PSOs):

By the end of M. Sc. Applied Geology program the student will have following Program specific outcomes:

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<th>PSO</th>
<th>Knowledge of Geological discipline</th>
<th>Demonstrate Understanding and in-depth knowledge of the geological processes, geological resources and geodynamics</th>
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<td>PSO2</td>
<td>Critical analysis of Geological problems and innovation</td>
<td>Acquire skills to critically analyze complex Geological problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context</td>
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<td>PSO3</td>
<td>Research methodologies and Research Ability</td>
<td>Ability to think, visualize and search in various domains to identify research gaps and hence to provide solution to new ideas and innovations.</td>
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4. PEO / PO Mapping:

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MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

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**Total Credits** 14
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### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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## SUMMARY

**M. Sc. APPLIED GEOLOGY (2 YEARS)**

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**Total** | 21 | 24 | 22 | 18 | 85 |
OBJECTIVES:
- To impart knowledge on the origin, types and characteristics of landforms and processes.
- Give better understanding on the applications of geomorphology in geological and engineering fields.
- Providing adequate knowledge on groundwater and natural hazards Management.

UNIT I  INTRODUCTION TO GEOMORPHOLOGY  7
Basic concepts, endogenous and exogenous processes, Davisian/Geomorphic cycle, Planation surfaces, Processes of weathering, Weathering Indices and their significance.

UNIT II  FLUVIAL AND COASTAL PROCESSES AND LAND FORMS  12
Classification of rivers and river valleys; Drainage basin - drainage morphometric parameters, work of river, river capture. Classification of coasts, coastal processes and landforms, coastal geomorphology of India, Coral reefs – types and significance.

UNIT III  AEOLIAN AND GLACIAL PROCESSES AND LANDFORMS  9
Origin of deserts; causes of aridity and desertification; types and ages of deserts, Aeolian landforms. Process of glaciation; classification of glaciers; Glacial landforms; glacial erosion and deposition processes. Glaciation in the Himalayas.

UNIT IV  APPLIED GEOMORPHOLOGY  9
Geomorphology in resources exploration; Hydro-geomorphology : Role of geomorphic processes and land forms in localization of ores and minerals - Coastal, alluvial and eluvial placers - Residual deposits; Engineering geomorphology – concept and applications.
Geomorphology in natural hazard management – floods, landslides, coastal erosion, tsunami and other natural disaster.

UNIT V  PLANETARY GEOMORPHOLOGY  8
Need for the study. Comparison of terrestrial and planetary landforms. Description and origin of Lunar, Martian and other planetary landforms and processes, methods of mapping planetary landforms.

TOTAL: 45 PERIODS

OUTCOMES
On completion of this course, the students expected to be able to:
- Understand the endogenetic and exogenetic processes of the Earth.
- Have better understanding of geological actions of wind, river, sea and glaciers and their related landforms.
- Appreciate and comprehend the advanced concepts of geomorphology and its applications in Geology and engineering.
- Gain knowledge on role of geomorphology in geological hazards and its mitigation.
- Understand the planetary geomorphology.

REFERENCES
OBJECTIVES:
• To impart fundamentals of crystals and crystallization processes.
• Teach students on formation of minerals and their physical and chemical characteristics
• Enabling them to understand the potentiality of economic resources for exploration.

UNIT I  CRYSTALLOGRAPHY
Classification of crystals-systems and classes of symmetry- International system of crystallographic notation- Use of projection diagrams to represent crystal symmetry-Unit Cells, Motifs and Lattices-Bravais Lattices-Miller indices-Point groups and space groups.

UNIT II  ELEMENTS AND MINERALS
Stoichiometry, atomic substitution-polymorphism, isomorphism and solid solution series – exsolution-Chemical bonding types and mineral properties-chemical classification of minerals-Rules governing atomic close-packing in crystalline solids and co-ordination number. Pauling’s rules and coordination polyhedral-Crystal imperfections-defects, twinning and zoning Positioning of trace elements in minerals.

UNIT III  DESCRIPTIVE MINERALOGY

UNIT IV  OPTICAL MINERALOGY

UNIT V  X-RAY CRYSTALLOGRAPHY
Principle of X-ray powder diffraction, Measurement of X-ray powder diffraction patterns, Powder diffractometers, Goniometer design in powder diffractometry, Monochromatic radiation, Bragg-Brentano geometry, Debye-Scherrer geometry.
OUTCOMES:
On completion of this course, the students expected to be able to:

- Understand the crystallography and crystal symmetry
- In-depth knowledge on the elementary properties of minerals.
- Better understanding on the physical and chemical properties of various rock forming minerals and their identification.
- Gain knowledge on identification of minerals through their optical properties.
- Understand various x-ray techniques for and their applications in mineralogy.

REFERENCES

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AG5103 STRATIGRAPHY AND PALAEONTOLOGY  
OBJECTIVES:
- To understand the geological setting of Indian continent to its mineral deposits
- To understand the geological past events and paleoclimate.
- To understand the evolution of life and Paleoenvironment

UNIT I PRINCIPLES OF STRATIGRAPHY 9+6
Introduction and scope of stratigraphy, Principles of stratigraphy; code of nomenclature of India, litho, bio Chrono and magnetostratigraphic units, principles of stratigraphic correlation, Walther’s law. Geological time scale. Geological, physical and biological events through geological time.

Practical component: Geological events, evolution of life and mass extinctions in Indian stratigraphic scale, Order of superposition studies. Description of a litho profile.
UNIT II PRECAMBRIAN STRATIGRAPHYOF INDIA  

Practical component: Locating the Archean cratons, mobile belts, CTZ, Precambrian terrain on India map. Spotting the Precambrian mineralized zones on the map.

UNIT III PHANEROZOIC STRATIGRAPHY OF INDIA  
Paleozoic; Spiti, Kashmir and Kumaon. Mesozoic; Spiti, Kutch, Narmada valley and Trichinopoly. Gondwana Super group. Cenozoic; Assam, Bengal basin, Garhwal-Shimla Himalayas. Siwaliks; Stratigraphic boundary problems in Indian stratigraphy.

Practical component: Demarcation of stratigraphic boundary based on fossil assemblages.

UNIT IV INVERTEBRATE AND VERTEBRATE PALEONTOLOGY  


UNIT V MICROPALAEONTOLOGY AND PALYNOLOGY  


TOTAL: 75 PERIODS

OUTCOMES:
On completion of this course, expected outcomes are:

- A comprehensive knowledge of mineral wealth of India; a guide for exploration and exploitation of mineral deposits.
- Education to “past is key to the present” concept for correlation and enhancement the mineral and fossil fuel mineral exploration.
- Indexing the fossil system for paleoenvironment, paleotemperature, paleoecology, paleobathymetry in taking the stock of past sea level changes and global warming.
- Bio-indicator clue in pollution and bio-mineralization.
- A guide to the environment analysis by microfossil assemblages.

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AG5104  STRUCTURAL GEOLOGY AND GEOTECTONICS  L T P C
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OBJECTIVES:
- To teach fundamentals of rock deformation and geotectonics.
- To provide description on various geological structures and their field identification.
- To impart knowledge their significance in geological setup and exploration of geological resources.

UNIT I  INTRODUCTION
9
Concept, approach and scope of structural geology-primary and secondary structures-Principles of geological mapping and map reading-V-rules and outcrop patterns-projection diagrams. Stress, strain and rheological properties of rocks-Behaviour of minerals, sediments and rocks under deformation conditions.

UNIT II  DEFORMATION MECHANISMS & MICROSTRUCTURES
9
planar and linear structures- cleavage, foliation, lineation and unconformities-Structural behaviour of igneous intrusions-Introduction to petro fabrics, Kinematic analysis and Dynamic analysis-deformation at microscaledynamic and static recrystallization-controls of strain rate and temperature on development of microlabic.

UNIT III  JOINTS AND FAULTS
9
Joints and shear fractures- brittle and ductile shear zones - Mohr's circle and criteria for failure of rocks- Fault in rocks-recognition in field-classification of faults and fault surfaces on the basis of slip sense and surface effects- Dynamic analysis of faults- measurement of strain in deformed rocks- time relationship between crystallisation and deformation - Normal faults, strike-slip faults and thrust faults terminology-role of fluid pressure- calculation of paleostress.

UNIT IV  FOLDS
9
Elements of fold geometry-classification of folds. Folding mechanisms- Regional fold styles-structural analysis of folds -Study of Superimposed folding-Type 1, 2 and 3 interference pattern. S and Z patterns-Stereoplot for different interference pattern-Distinction between F1 and F2 folds.

UNIT V  GEOTECTONICS
9

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the students expected to be able to:

- Identify primary and secondary structures
- Have knowledge on behaviour of minerals and rocks during stress
- Acquire skills on field recognition of faults, folds and their types
- Understanding of plate tectonics and its role in geological processes such as seismicity and volcanism.
- Have knowledge on geological and structural mapping and its application in geo resource exploration.

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AG5111 STRUCTURAL GEOLOGY LAB AND GEOLOGICAL MAPPING TECHNIQUES

OBJECTIVES:
- To teach field measurements of attitude of rocks
- To impart geological mapping techniques.
- Provide skills to determine bed thickness and depth

UNIT I STRIKE, DIP AND THICKNESS PROBLEMS 12
Studies of contours and different land forms – Strike, true dip and apparent dip problems - Measurement of thickness and width of the outcrops.

UNIT II STRUCTURAL MAPS AND STEREOGRAPHIC PROJECTIONS 12
Completion of outcrops in geological maps - Three point problems - Drawing of profiles and studies of geological maps - Determination of true and apparent dip, plunge and pitch of linear structures. Computer aids to analysis of structural data.
UNIT III GEOLOGICAL MAPPING TECHNIQUES
Map-toposheet-study of topographic features-map scale-mapping instruments – Clinometer, brunton compass, odometer, altimeter, GPS, Map measurer, and Geologist’s kit.-Procedures for geological mapping at Igneous, Sedimentary and Metamorphic terrains- Outcrop study and method of traverses.

UNIT IV LITHOLOG AND GEOLOGICAL MAP
lithological descriptions and litho-logging-Structural mapping, joints pattern measurements, faults identification, fold analysis and sample collection-Preparation of geological map.

UNIT V GEOLOGICAL FIELD WORK
Preparation of field area base map-Contour and drainage map-traversing methods-Methods of rock samples and fossil collection-Field work dairy writing-Field kits-Preparation of lithological cross sections, colour and symbol used in geological mapping-Visit to igneous, metamorphic and sedimentary fields.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Measure attitude of rocks
- Prepare geological profile
- Prepare structural map and analyze data using computing methods
- Prepare lithology and carryout geological mapping.
- Carryout geological field work individually and as a team

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AG5112 MINERALOGY LAB L T P C 0 0 2 1

OBJECTIVES:
- To give hands-on exercise on identification of crystals and minerals
- To impart practical training on optical mineralogical techniques
- To provide skills in economic minerals identification

UNIT I CRYSTALLOGRAPHY AND MEGASCOPY
UNIT II  
**OPTICAL PROPERTIES OF MINERALS**  
Systematic microscopic study of common rock forming minerals – RI – Birefringence – extinction angles – optic sign etc.

UNIT III  
**MINERAL CALCULATION AND 4- AXES UNIVERSAL STAGE**  
Calculation of structural formula for important rock forming mineral groups. Determination of anorthite content and twin law in plagioclase feldspars.  

**OUTCOMES:**  
On completion of this course, the students expected to be able to:  
- Identify and name various minerals  
- Have knowledge on their physical and chemical properties  
- Acquire skills on recognition of minerals using their optical properties  
- Understanding on various techniques to recognize rock forming minerals.  
- Have knowledge on mineralogy and its practical applications for geology

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**AG5113  PLANE AND GEOETIC SURVEYING LABORATORY**  

**OBJECTIVES:**  
- To familiarize students with the various surveying instruments.  
- To impart practical skills on various surveying techniques.  
- Provide skills to do individual and group surveys for geological explorations

**EXCERCISES:**  
1. Chain traversing  
2. Compass traversing  
3. Plane table surveying – Method of intersection  
4. Plane table surveying – Three point problem(any one method)
5. Plane table surveying – Two point problem 4
6. Plane table traversing 4
7. Fly levelling using dumpy/tilting level 4
8. Check levelling using dumpy/tilting level 4
9. Measurement of horizontal and vertical angles using theodolite. 8
10. Determination of tacheometric constants using horizontal and inclined line of sight. 4
11. To determine the elevation of an object using single plane method when base is accessible and inaccessible 4
12. GPS and Total Station – demonstration only. 4

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:

- Use various surveying instruments individually
- Have knowledge on different survey method with its merits and demerits
- Do individual field surveys
- Understand applications of Survey in geological explorations.
- Have up-to-date knowledge on advanced surveying instruments and methods

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai 600 025
OBJECTIVES:

- To study the physical properties of earth and application of physics in geology,
- To understand subsurface features and structures for better understanding of subsurface geology.
- To Familiarize the students on geophysical techniques and their field setup, data processing and interpretation.

UNIT I  INTRODUCTION & ELECTRICAL METHODS  9+6

FIELD TECHNIQUES:-  Resistivity surveys – Wenner and Schlumberger methods – electrical sounding and profiling – problems on these methods

UNIT II  GRAVITY METHODS  9+6

FIELD TECHNIQUES:-  Field investigation on resistivity – sounding and profiling – SP methods - Interpretation of data – standard computer packages in interpretation – Problems on gravity methods

UNIT III  MAGNETIC METHODS  9+6
Magnetic methods – principle - field procedure – magnetometers – interpretation of magnetic data – size and shape of bodies – correction of magnetic data - applications - airborne geophysical surveys – case studies

FIELD TECHNIQUES:-  Problems on magnetic methods – preparation of anomaly maps – methods of corrections

UNIT IV  SEISMIC METHODS  9+6

FIELD TECHNIQUES:-  Problems on refraction and reflection methods – 3 layer and inclined beds – calculation based on intercept time and cross over distance

UNIT V  RADIOACTIVITY METHODS AND WELL LOGGING  9+6

FIELD TECHNIQUES:-  Radioactive methods - problems on well logging – interpretation of data

TOTAL: 75 PERIODS

OUTCOMES:
On completion of this course, the students are expected to be able to:

- Have better understanding on the physical properties of earth and its layers
- Understand the geophysical anomalies and their significance in subsurface exploration
- Acquire skills on various geophysical methods and their field surveys
- Collect data using various geophysical techniques and do analysis
- Interpretation of data for exploration for minerals, oil and groundwater
REFERENCES:
4. John M. Reynolds, An Introduction to Applied and Environmental Geophysics Reynolds Geo-

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AG5202 GEOCHEMISTRY L T P C

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OBJECTIVES:
- To study the chemical properties of earth, minerals and application of chemistry in geology.
- To understand chemistry of magma and evolution of various rock types through geochemical diffination.
- Also to understand various surface guides for exploration of economical ores and minerals.

UNIT I PRINCIPLES OF GEOCHEMISTRY 9

UNIT II GEOCHEMISTRY OF MINERALS, ROCKS AND WATERS 9
Mineral stability, compositional changes in minerals. River water, Seawater, Seafloor hydrothermal systems; Groundwater and Lakes. Characteristics of Magma, Melting of rocks, Water in Magmas, eutectic and melting. Distribution of trace components between rocks and melts. Goldschmidt’s classification of elements; fractionation of elements in minerals/rocks;

UNIT III ISOTOPE GEOCHEMISTRY 9
Radioactive Decay, Determining Isotope Decay time, Potassium-Argon Systematics, Uranium-
Thorium-Lead Systematics. Types of Isotope- Fractionation, isotope Exchange between minerals and water, Carbon, Oxygen and Sulphur isotopes, First-order decay and growth equations.
UNIT IV  EXPLORATION GEOCHEMISTRY  9
Introduction – Primary dispersion pattern, Secondary dispersion pattern – background values. Geochemical anomaly – geochemical sampling-Principles and techniques used in the design and implementation of an exploration geochemical survey-Nernst’s partition coefficient (compatible and incompatible elements)-Nernst-Berthelot partition coefficient and bulk partition coefficient-Fick’s laws of diffusion and activity composition relation (Roult’s and Henry’s law).

UNIT V  ENVIRONMENTAL GEOCHEMISTRY  9
Application of trace elements in petrogenesis-principles of equilibrium and Rayleigh fractionation-REE patterns, Eh and pH diagrams and mineral stability- Anthrosphere aquatic environment – Marine, fluvial, lacustral, aerosols-Perturbations caused by human activity.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students are expected to:
• Familiarized with chemical properties of earth and its layers
• Understand the geochemical characteristics of minerals and rocks
• Have knowledge on is isotopic methods and age determination
• Collect geochemical data for exploration of earth resources
• Analyze and Interpret geochemical data for exploration for minerals, oil and groundwater.

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
OBJECTIVES:
- To familiarize the students on the igneous processes
- To provide knowledge on physical and chemical characteristics of magma, and various rock types.
- Provide information on occurrence and geological setting of igneous rocks and metamorphic rocks.

UNIT I  MAGMA GENERATION AND IGNEOUS ROCKS  9

UNIT II  PHASE EQUILIBRIA IN IGNEOUS SYSTEMS  9

UNIT III  PLATE TECTONICS AND IGNEOUS PETROGENESIS  9
Igneous rocks of ocean basins: Ophiolites & Basalts - Igneous rocks of Continental Lithosphere: Granitic rocks; terrestrial anorthosites, carbonatites &Alkaline rocks; Continental Rhyolites; Continental Flood Basalts - Igneous rocks of convergent margins - Distribution and tectono magmatic setting of important igneous complexes of India.

UNIT IV  METAMORPHIC PETROLOGY  9

UNIT V  METAMORPHIC FACIES & METASOMATISM  9
Facies classification and systematic description of regional and thermal metamorphism pelitic, basic-ultrabasic and impure calcareous rocks. Metasomatism, ultametasomatism and anatexis. Metamorphism and plate tectonics. Paired metamorphic belts – EPMA Studies – PT Estimates –ITD.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students are expected to
- Have better understanding on magma and magmatic processes
- Understand the crystallization processes of minerals and rocks
- Differentiate various Igneous types and their tectonic settings
- Understand clearly on metamorphic processes and formation of metamorphic rocks.
- Interpret magmatic and geodynamic processes and their signatures worldwide.

REFERENCES
AG5204 SEDIMENTOLOGY AND SEDIMENTARY PETROLOGY

OBJECTIVES:

- To familiarize the students on Sedimentary processes
- To provide knowledge on sedimentary structure and tectonic settings
- Describe on occurrence and geological setting of igneous rocks and metamorphic rocks.

UNIT I

ORIGIN AND CLASSIFICATION OF SEDIMENTS
Weathering and erosion process, products, principles of sedimentation process, scope, applications, classification of sedimentary rocks, sedimentary textures-grain size, roundness, sphericity, shape and fabric, quantitative grain size analysis.

UNIT II

SEDIMENTARY PROCESS AND STRUCTURES
Sediment transport and deposition- fluid and sediment gravity flows, lamellar and turbulent flows, Reynold number, Froude number, grain entrainment, Hjulstrom diagram, bed and suspension load transport. Primary, penecontemporaneous deformation structures and biogenic structures. Paleocurrent analysis.

UNIT III

SEDIMENTATION AND TECTONICS
Evolution of sedimentary basins. Sedimentation in major tectonic setting; principles of sequence stratigraphy- concepts and factors controlling base level changes, parasequence, clinoform, system tract, unconformity and sequence boundary. Sedimentary basins of India.

UNIT IV

SEDIMENTARY ENVIRONMENT AND FACIES

UNIT V

SEDIMENTARY PETROLOGY
Sandstones, mudstone, carbonate sedimentary rocks, banded iron formation, evaporates, cherts, and Phosphorites; classification, texture, structure, origin, diagenesis and depositional environment.

TOTAL: 45 PERIODS
OUTCOMES
On completion of this course, the students are expected to
- Have better understanding on sediments and classification
- Understand the processes of sedimentation and sedimentary structures
- Differentiate various tectonic settings and sedimentary processes
- Understand clearly on sedimentary environment and provenance
- Identify and distinguish sedimentary rocks on the basis of their mode of formation.

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AG5211 GEOCHEMISTRY LAB L T P C 0 0 4 2

OBJECTIVES:
- To develop analytical skill and practical exposure on geochemistry to the students
- To understand the chemical properties of water, sediments and minerals.
- Training on sophisticated analytical instrument handling in geochemistry and their application in geology.

UNIT I ANALYSIS OF ORES 12
Dolomite, Galena, Haematite by titrimetric / gravimetric methods

UNIT II ANALYSIS OF METALS IN SOLUTIONS 16
Estimation of iron, copper, sodium, potassium, zinc and nickel by titrimetric / gravimetric / spectroscopy methods
UNIT III  ANALYSIS OF WATER  12
Acidity, alkalinity, hardness by titrimetry method-total dissolved solids by gravimetry method-
Determination of dissolved oxygen

UNIT IV  ELECTROANALYTICAL METHODS  12
pHmetry, conductometry and potentiometry

UNIT V  DEMONSTRATION EXPERIMENTS  8
AAS, IR, TGA, DSC, SEM, BET and Chromatographic techniques

TOTAL: 60 PERIODS

OUTCOMES
On completion of this course, the students are expected to be able to:
• Analyze different type of ores.
• Estimate the percent of metals in solution using chemical methods
• Determine the quality of water using analytical techniques.
• Have skills on electroanalytical methods
• Have up-to-date knowledge on modern and advanced equipment.

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AG5212  IGNEOUS, METAMORPHIC AND SEDIMENTARY  PETROLOGY LAB  L T P C  0 0 4 2

OBJECTIVES:
• To develop practical exposure and skills on Petrography of rocks
• To understand the index chemical and physical properties for mineral and rock identification
• Training on sophisticated microscopes and analytical instrument handling in Petrology

UNIT I  IGNEOUS PETROGRAPHY  9
Study of textures and structures of igneous rocks. - Systematic megascopic and microscopic study of the following igneous rocks: granite, granodiorite, syenite, diorite, gabbro, dolerite, basalt and rhyolite.

UNIT II  SEDIMENTARY PETROGRAPHY  9
Megascopic and microscopic identification of common sedimentary rocks, structures, textures
UNIT III METAMORPHIC PETROGRAPHY

Study of textures and structures of important metamorphic rocks - Systematic megascopic and microscopic study of important and common metamorphic rocks: Microscopic study of hornblende schist, mica-granite-schist, marble, quartzite, amphibolite, Charnockites etc.

UNIT IV PETROCHEMICAL CALCULATIONS


UNIT V SEDIMENTARY TECHNIQUES


OUTCOMES:

On completion of this course, the students are expected to be able to:
- Identify different types of megascopic rock samples.
- Distinguish rock types under microscope and identify constituent minerals
- Determine the chemical composition of rocks and classify them.
- Have skills on sedimentary analysis of rocks
- Have up-to-date knowledge on modern and advanced equipment

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TOTAL: 60 PERIODS
AG5213  SEMINAR  L T P C  0 0 2 1

OBJECTIVES
- To work on a specific technical topic in Geology and
- To acquire the skills of written and oral presentation
- To acquire writing abilities for seminars and conferences

SYLLABUS
The student will work for two hours per week guided by a group of staff members. They will be asked to give a presentation on any topic of their choice related to Geology and to engage in discussion with the audience. A brief copy of their presentation also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on a technical topic. They will defend their presentation. Evaluation will be based on the technical presentation and the report and also on the interaction shown during the seminar.

TOTAL : 30 PERIODS

OUTCOME
- The students will be trained to face an audience and to tackle any problem during group discussion in the interviews.

AG5301  ECONOMIC GEOLOGY  L T P C  3 0 0 3

OBJECTIVES:
- To familiarize the students with the ore forming processes
- To provide knowledge on conditions and mode of occurrences of ores and minerals
- To understand geological setting of Indian and global ore and mineral reserves.

UNIT I  PRINCIPLES OF ECONOMIC GEOLOGY  9
Introduction to ore and industrial minerals- Physical and optical properties of ore minerals - The nature and morphology of the principal types of ore deposit - Textures and structures of ore and gangue minerals - Classification of ore deposits - Fluid inclusion studies - Wall rock alteration - Geothermometry, Geobarometry, Paragenitic Sequence, Zoning and dating of ore deposits.

UNIT II  INTERNAL PROCESSES  9
Oregenesis- Ore deposits and ore minerals- source and migration of ore constituents and ore fluid-magmatic and pegmatitic deposits (chromite, Timagnetite, Diamond, Cu-Ni sulphide, PGE, REE, muscovite, rare metals)-Porphyry, skarn and hydrothermal mineralization (porphyry Cu-Mo, greisen Sn-W, skarn, VMS and SEDEX type sulphide deposits, orogenic gold)-Mineralisation associated with (i) Ultramafic, mafic and acidic rocks, (ii) greenstone belts, (iii) komatites, anorthosites and kimberlites and (iv) submarine volcanism- Magma-related mineralisation through geological time- Stratiform and stratabound ores- Ores and metamorphism — cause and effect relations.

UNIT III  SURFACE PROCESSES  9

UNIT IV  GLOBAL TECTONICS AND METALOGENY  9
Patterns in the distribution of mineral deposits – continental growth rates - crustal evaluation and metallogenesis – metallogeny through time – plate tectonics and ore deposits. Application of fluid inclusion study and stable isotope geochemistry in understanding ore forming processes.
UNIT V  INDIAN MINERAL DEPOSITS AND MINERAL ECONOMICS


TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students are expected to be able to:
- Distinguish various ore minerals and gangue.
- Understand internal processes of economic ore formation
- Comprehend surface processes and related ore deposits.
- Understand global occurrence of economic minerals through geologic time
- Have up-to-date knowledge on Indian ore deposits and National mineral policy

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6. Anthony Evans, Ore Geology and Industrial Mineral, Jhon Wiley & sons, USA, 1993

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AG5302  ENGINEERING GEOLOGY

OBJECTIVES:
- To provide the knowledge of geological investigation for site selection for engineering projects.
- To provide the knowledge on Rock type and their engineering properties, suitability of site conditions for dam, Tunnel, coastal structure constructions.
- To provide the knowledge to understand the recent trends in geotechnical engineering.

UNIT I  SURFACE AND SUBSURFACE GEOLOGICAL INVESTIGATIONS

Field investigations-electrical and seismic geophysical methods in subsurface geological investigations for foundation engineering-Description of discontinuities-bed rock attitudes, thickness, calculation of True thickness and vertical thickness of bed rock-Geological information for slope stabilization.
UNIT II ENGINEERING PROPERTIES OF ROCKS AND SOILS 9
Elementary concepts of rock mechanics and soil mechanics. Rock description and engineering classification of rocks – weathering and its significance in engineering site- Engineering properties of rocks and soils, RMR, RQD methods-determination of engineering properties in field and laboratory.

UNIT III GEOLOGICAL INVESTIGATIONS FOR DAMS&TUNNELS 9
Dams -geological investigations- suitability of site, geological profile from catchment area to Dam site- lithology, structures, topography, slope, drainage system- groundwater studies in reservoir sites-reservoir site investigations, siltation analysis-Geological investigations for soft rock and hard rock tunnels construction.

UNIT IV GEOLOGICAL INVESTIGATIONS FOR COASTAL DEVELOPMENT 9
Coastal erosion and accretion process and its impact-Geological investigations for harbor construction-Coastal protection structures-Sea walls, bulk heads, groins, jetties.

UNIT V GEOTECHNICAL STUDIES OF LANDSLIDES AND SUBSIDENCE 9
Landslide - Classification, causative factors, control measures. Land subsidence, factors, causes and remedial measures. Geological considerations for monitoring of landslides. geotechnical problems related to foundation for bridge and building site investigations. Recent trends in geotechnical engineering. Geotechnical case studies of major projects in India.

TOTAL: 45 PERIODS

OUTCOMES:
• Students will understand the field investigation techniques
• Students will able to understand the rock mechanics and soil mechanics and engineering properties of rocks and soils
• Students will understand the importance of geological considerations in dams and tunnel site investigations
• Students will understand the coastal processes and coastal protection structures
• Students will able to understand the recent trends in geotechnical engineering

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
OBJECTIVES:
- To teach hydrogeological process in the earth system
- To learn estimation of aquifer parameters and potential for groundwater development using geophysical approach
- To teach assessment of groundwater quality through hydrogeochemical techniques.

UNIT I  INTRODUCTION

UNIT II  GROUNDWATER FLOW

UNIT III  ESTIMATION OF AQUIFER PARAMETERS

UNIT IV  GROUNDWATER DEVELOPMENT

UNIT V  GROUNDWATER QUALITY

OUTCOMES:
On completion of this course, students are expected to be able to:
- Understand the field investigation techniques for groundwater
- Determine the hydraulic conductivity and groundwater resources
- Estimate aquifer parameters using various methods
- Understand the well development and yield testing
- Analyze and determine water quality and do remediation.

REFERENCES
4 Elango, L and Jayakumar, R (Eds.) Modelling in Hydrogeology, Unesco-IHP Publications, Allied Publ, 2001
7 Hiscock, K, Hydrogeology: Principles and Practice, Wiley-Blackwell, 2005
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**AG5304 GEOLOGICAL REMOTE SENSING AND GIS**  

**OBJECTIVES:**
- To teach principle and concepts of Remote Sensing, Image processing and GIS,
- To train the students in aerial photo and satellite image interpretation, satellite image processing,
- To teach GIS techniques, buffering and layer analysis for geologic applications.

**UNIT I REMOTE SENSING AND PHOTOGRAMMETRY**  

Introduction to remote sensing, aerial and space borne platforms. Global and Indian missions; Spectral properties of natural and geologic features, Photogrammetry – principles and concepts., Image interpretation elements.

**Hands on exercise:** Elements of aerial photos, satellite images and topographic maps; Setting up of stereoscope, determination of stereoscopic acuity and orientation of aerial photographs under a stereoscope; Interpretation of aerial photographs and satellite images and delineation of tonal and textural units

**UNIT II DIGITAL IMAGE PROCESSING AND GIS**  

Format and Structure of multispectral digital image data; Image pre-processing: Image Enhancements; Image classification; relevance to geology. Introduction to GIS. Components of GIS ; Type of data – spatial and non spatial data – data structure – database concepts – data input – retrieval – vector and raster formats –; standard GIS packages – buffering and overlay analysis; Assigning rank and weights for geologic studies.

**Hands on exercise**: Familiarisation with Image Processing and GIS softwares; Enhancement, Ratioing, PCA and fusion of digital images; Unsupervised and Supervised classification of satellite images; Digitization and generation of thematic maps in a GIS.

**UNIT III GEOLOGICAL AND GEOMORPHIC MAPPING**  

Introduction to Geomorphology, Significance of landforms - Image characters of landforms. Role of aerial photographs and satellite images in Geomorphic mapping. Lithologic and structural mapping using aerial photos and satellite images.

**Hands on exercise**: Geomorphic, Structural and Lithologic interpretation from Aerial photos and satellite images.

**UNIT IV GEOLOGICAL APPLICATIONS**  

Remote sensing and GIS for mineral exploration, ground water exploration and petroleum exploration. Case studies with methodology.
Hands on exercise: Analysis of aerial photos and satellite for mineral exploration, ground water exploration and petroleum exploration.

UNIT V GEO HAZARDS & GEO-ENVIRONMENTAL APPLICATIONS 8 + 6
Remote sensing and GIS for Landslides and Earthquake studies, Coastal erosion and accretion studies and Coastal Zone Management.

Hands on exercise: Analysis of aerial photos and satellite for landslide, earthquake and coastal hazards study.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of this course, the student can
- Recognize geological and geomorphic features in images
- Perform satellite image processing for earth resources
- Interpret satellite imageries and carry out geo-hazard studies.
- Prepare GIS based maps for various themes like Geology, Geomorphology etc
- Knowledge will be gained on GIS for earth resources and geo-hazards studies.

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AG5311 HYDROGEOLOGY LAB L T P C
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OBJECTIVES:
- To develop analytical skill and practical exposure on hydrogeology to the students
- to understand the aquifer parametersand water budgeting
- Training on analytical instrument handling for determining groundwater quality
UNIT I  POROSITY AND HYDRAULIC CONDUCTIVITY  
Groundwater prominence – Hydrological cycle-problems using porosity and specific yield-Hydraulic conductivity – vertical and horizontal-groundwater gradient and contour map preparation-flow velocity – properties of various geological formations-permeameter experiments

UNIT II  AQUIFER PARAMETERS  
Determination of hydraulic conductivity in lab – problems on groundwater flowto wells - steady and unsteady flow – estimation of transmissivity and storage coefficient of wells-aquifer compressibility.

UNIT III  WATER BUDGETING  
Unsteady flow - Theis recovery methods - Use of computer codes to understand groundwater flow in aquifers – slug tests-water budgeting

UNIT IV  GROUNDWATER QUALITY  
Determination of ion balance error – problems on hydrochemistry – preparation of water quality diagrams-drinking and irrigation water quality

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, students are expected to be able to:
- Estimate groundwater parameters
- Determine the hydraulic conductivity and storativity
- Estimate aquifer parameters using various methods
- Carryout water budgeting
- Determine groundwater quality

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AG5312  GEOLOGICAL FIELD WORK AND INDUSTRIAL TRAINING  

OBJECTIVES:
- To train the students in the field work so as to have a firsthand knowledge of preactical problems related to geology in carrying out field and industrial geological tasks.
- To develop skills in facing and solving field problems
SYLLABUS

The students individually undertake training in reputed industries during the summer vacation for a specified period of three to four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30 PERIODS

OUTCOME
• They are trained in tackling a practical field/industry oriented problem related to Geology

AG5411 DISserTATION

OBJECTIVES:
• To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature
• To develop the methodology to solve the identified problem
• To train the students in preparing project reports and to face reviews and viva-voce examination

SYLLABUS

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the Head of the department. The students will be evaluated through a viva-voce examination by a panel of the examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOME:
• On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

AG5001 ADVANCED REMOTE SENSING TECHNIQUES AND GIS FOR GEOLOGICAL APPLICATIONS

OBJECTIVES:
• To teach on the hyper spectral sensors and imagine devices
• To describe the students on image processing techniques and information extraction.
• To understand various applications of remote sensing and GIS in exploration of economical ores and minerals.

UNIT I HIGH RESOLUTION SENSORS AND HYPERSPECTRAL IMAGING DEVICES
Introduction - need for high resolution data. Characteristics, specifications and applications. Spectrographic imagers-hyperspectral sensors- airborne and space borne..
UNIT II IMAGE PROCESSING AND INFORMATION EXTRACTION

UNIT III GEOGRAPHIC INFORMATION SYSTEM(GIS)

UNIT IV DATA ANALYSIS AND MODELLING USING GIS

UNIT V APPLICATIONS OF GIS
Application to groundwater / recharge studies - landslides - Mineral investigation - Petroleum exploration using GIS - GIS and ore- body modeling - coastal studies.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the working principles of high resolution sensors and imaging devices.
- Comprehend image processing and classification techniques
- Appreciate the advanced concepts of data analysis and retrieval of data
- Modeling using remote sensing and GIS
- Gain knowledge on role of GIS in geological hazards and its mitigation

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OBJECTIVES:
- To train the students to address the mathematical problems involved in geological science
- To have understanding on various sampling, quantitative techniques
- Enable them to solve statistical problems pertaining to geology.

UNIT I  SYSTEM OF LINEAR EQUATIONS AND INTERPOLATION  9

UNIT II  NUMERICAL INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS  9

UNIT III  EMPIRICAL STATISTICS  9
Types of Sampling - Description of discrete and continuous data – Measures of Central tendency and dispersion for grouped and ungrouped data – Measures of position – Box and Whisker plot.

UNIT IV  ESTIMATION THEORY  9

UNIT V  TESTING OF HYPOTHESES  9
Sampling distributions - Type I and Type II errors - Tests based on Normal, t, \( \chi^2 \) and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

TOTAL: 45 PERIODS

OUTCOMES (CO):
On completion of this course, the students expected to be able to:
- Understand the linear equation and interpolation of data
- Have better understanding of the applications of numerical integration and differential equation in Geological sciences.
- Apply statistics and sampling techniques in Geological studies
- Gain knowledge on regression and correlation analysis for Geological Data.
- Understand the quantification and error limits of geological data and gain ability for a better representation.

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OBJECTIVES:
- To study the chemical properties of Groundwater.
- To understand various reactions and ion exchange processes that affect quality of water.
- Also to understand interactions between water and minerals in surface and subsurface formations.

UNIT I  GROUNDWATER SAMPLING AND EQUILIBRIUM  9
Chemical parameters - sampling and influence of well conditions - sampling for environmental isotopes - pore water sampling - Chemical processes in relation to hydrogeology - calculation of parameters - representation of results - thermodynamics - law of mass action - activity coefficients - saturation indices with respect to common minerals.

UNIT II  CARBONATE REACTIONS  9
Carbonate system - solution - precipitation - role of pH and alkalinity - carbonic acid and carbonate equilibrium constants - case studies.

UNIT III  REDOX REACTIONS  9

UNIT IV  ION EXCHANGE PROCESSES  9
Adsorption - absorption - surface complex - reasons for surface charge - isotherms - distribution coefficient - ion exchange - cation exchange capacity - case studies.

UNIT V  SILICATE WEATHERING  9
Hydrochemical sequences - major - ion evolution - groundwater incrustation rocks - hydrochemical processes during flow - clay minerals and changes in water chemistry due weathering.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Groundwater sampling and calculation of chemical parameters.
- Have better understanding on role of carbonate and Redox reactions on mineral stability.
- Comprehend the ion exchange processes and distribution of coefficients.
- Gain knowledge on role of hydrogeochemical sequences.
- Understand the relationship between clay minerals and water chemistry during weathering.

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OBJECTIVES:
- To study the origin and formation of Coal
- To teach ranking and exploration of Coal.
- To understand occurrences and distribution of Coal

UNIT I  ORIGIN AND FORMATION OF COAL
Origin - classification of coal, coalification process. Types of coal and its mode of occurrence physical and chemical characteristics of coal – macropetrographics – microlithotypes.

UNIT II  COAL PROPERTIES
Proximity and ultimate analysis, ranks of coal, concept of coal maturity, bituminous and anthracite coal. Gondwana coalfields – Paleogene and Neogene coalfields. Lignite deposits in India.

UNIT III  CLEAN COAL TECHNOLOGY
Coal Preparation; cleaning, sizing, washing. Beneficiation of Indian coals; Coal utilization – combustion, carbonization, gasification and hydrogenation.

UNIT IV  INDIAN COALFIELDS
Lithology, stratigraphy and structures of Gondwana coalfields and Tertiary coalfields of India; its properties.

UNIT V  COAL EXPLORATION METHODS
Exploration of coal, mining methods, drilling and logging, assessment of coal reserves; calculation of coal reserves. Mine Environment

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Differentiate between types of coal.
- Classify, rank and assess coal reserves.
- Have knowledge on coal washing techniques and beneficiation of coal.
- Gain knowledge on coal reserve management and environmental conservation.
- Have knowledge on geological and geographical distribution of Indian coal

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OBJECTIVES:
- To study the structure of the earth and plate tectonics
- To understand principles of seismic risk analysis.
- Also to teach seismic hazard assessment and management

UNIT I SEISMICITY

UNIT II SEISMIC RISK ANALYSIS

UNIT III SEISMIC HAZARD ASSESSMENT
Assessment of geological seismic hazards – site response and seismic microzonation – mapping of hazards due to liquefaction and earthquake – induced landslides – use of Geographical Information System for mapping and seismic risk assessment.

UNIT IV SEISMIC HAZARDS IN INDIA
Major seismic events in India – Reservoir induced Seismicity – dam failures due to earthquakes-structural damage – lessons learnt – techniques for field investigations.

UNIT V MITIGATION AND MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the fundamentals of seismicity.
- Carry out seismic risk analysis and seismic hazard mapping.
- Estimate and assess seismic hazard and prepare seismic microzoning maps
- Gain knowledge on use of GIS for hazard mapping and risk assessment
- Appreciate the impact of disasters on socio-economic system

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OBJECTIVES:
- To study the chemical properties of earth, minerals and application of chemistry in geology.
- To understand chemistry of Continental and marine environment
- Also to understand effect on environment and guides for exploration of economical resources.

UNIT I  PRINCIPLES OF ENVIRONMENTAL GEOCHEMISTRY  
The science of Geochemistry – Its objectives, its relationship to other geosciences and its methodology. The natural workings of the Earth: Natural distributions of chemicals in global and local environments. Geochemistry of the Earth: The birth of matter in our solar nebula, formation of the solar system and early geochemical history of the earth. The geochemical cycle – Distribution of elements in rocks

UNIT II  THE CONTINENTAL ENVIRONMENT  

UNIT III  MARINE ENVIRONMENT  

UNIT IV  ENVIRONMENTAL MINERALOGY  

UNIT V  GEOCHEMICAL EXPLORATION ENVIRONMENT  

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the principles of environmental geochemistry.
- Have better understanding of chemistry of continental environment
- Comprehend the physical and chemical properties of ocean water
- Gain knowledge environmental mineralogy
- Apply the knowledge for exploration of economical minerals and ores.

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OBJECTIVES:
- To provide the knowledge on Geology and environment, impacts due to mineral, soil and land degradation.
- To expose the students to assess various geological environments like terrestrial, aquatic, etc.
- To provide knowledge and guidelines to assess and plan various environmental issues.

UNIT I GEOLOGIC ENVIRONMENTS 12
Concept and scope of environmental geology – Geological characteristics of various environmental regimes – fluvial, coastal, marine, Aeolian, desert, and glacial. - Landforms as ecosystem units – Geomorphic controls on biodiversity and its conservation.

UNIT II TERRESTRIAL ENVIRONMENT 8
Environmental degradation due to mining and ore beneficiation – Air Pollution - sources of pollution - pollution due to dust and waste disposal-Mining – opencast – underground - disposal of industrial and radio-active waste - dumping stacking – rehandling – management - mineral processing - tailing ponds - acid mine drainage – siltation - soil and mineral resources and their conservation-National and International standards- impact and management – Indian case studies

UNIT III AQUATIC ENVIRONMENT 8
Geological factors influencing the formation of surface, groundwater and marine Waters – geological basis of groundwater, surface and marine water pollution and management with Indian case studies

UNIT IV GEOLOGY IN ENVIRONMENTAL PLANNING AND MANAGEMENT 8
Environmental impact assessment – geological appraisal of waste disposal sites - geology in planning and siting of land fills - problems of deep well disposal, radioactive waste management - land use planning in EIA

UNIT V GEOLOGICAL HAZARDS AND GLOBAL ENVIRONMENTAL CHANGE 9
Causes, types, Mitigation and Management of earthquakes, landslides, tsunami and volcanoes. ; Causes and Indicators of global environmental change

TOTAL: 45 PERIODS

OUTCOMES:
- Students will understand the earth processes and landforms
- Students will able to understand the terrestrial environment issues
- Students will learn about geological factors influencing the aquatic environment
- Students will understand the role of geology in environmental planning and management
- Students will able to understand the mitigation and management on geological hazards

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DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

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OBJECTIVES:
- To study the environmental impacts related to hydrogeology
- To teach groundwater problem in mines and slopes.
- To gain knowledge on groundwater contamination and protection

UNIT I INTRODUCTION
Hydrological cycle - geological formations as aquifers - aquifer parameters - their estimation - groundwater flow and recharge - environmental impacts related to hydrogeology.

UNIT II HYDROGEOLOGICAL IMPACTS

UNIT III GEOLOGICAL ASPECTS OF WASTE DISPOSAL SITES
Physiographic - nature of rock types - structure - hydrogeological considerations - data required - formation fluid tests - transport mechanisms of polluted groundwater.

UNIT IV GROUNDWATER CONTAMINATION

UNIT V GROUNDWATER PROTECTION
Groundwater contamination - methods of assessment - application of groundwater modeling - damage prevention - remediation of aquifers – bio remediation of contaminated aquifers

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Estimate aquifer parameters, flow and recharge of groundwater.
- Have better understanding on hydrological impacts on earth.
- Locate sites for solid waste and polluted water disposal using hydrological aspects.
- Assess groundwater contamination, sea water intrusion
- Modelling of pollution transport and remediation of aquifers.

REFERENCES
5. Marcel van der Perk, Soil and Water Contamination: From Molecular to Catchment, Scale, Taylor and Francis, 2006

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OBJECTIVES:
- To study the origin of Coal, petroleum and Nuclear minerals
- To teach Indian occurrences of hydrocarbons.
- To teach students geological and geophysical exploration techniques

UNIT I ORIGIN OF COAL AND ITS PROPERTIES

UNIT II INDIAN COAL FIELDS

UNIT III ORIGIN AND PROCESS OF HYDROCARBON FORMATION

UNIT IV GEOLOGICAL, GEOPHYSICAL AND GEOCHEMICAL METHODS
Sedimentary basin analysis to its Petrophysical properties, depositional environment and time line and bathymetry analysis. Seismic method of hydrocarbon reservoir exploration. Seismic reflection patterns and to decipher the depositional and structural features. Well logging techniques, interpretation of logs, geochemical parameters; determination of TOM, TOC, VRO, TTI, and TAMR.

UNIT V NUCLEAR MINERALS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the processes of formation of coal, petroleum and nuclear minerals.
- Have knowledge on different rank of coals and Indian occurrence
- Do independent geological mapping for hydrocarbon exploration
- Gain skills on geophysical and geochemical exploration methods.
- Understand the scope of geology in strategic mineral exploration

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Centre for Academic Courses
Anna University, Chennai-600 025

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OBJECTIVES:
- To familiarize the students with geological mapping techniques.
- To teach geophysical methods of prospecting for ores and minerals
- Also to provide knowledge on geochemical prospecting methods.

UNIT I GEOLOGICAL PROSPECTING
Geological prospecting - field survey and mapping techniques - field equipments - methods of mapping - pits and trenches - sampling - geological map preparation.

UNIT II ELECTRICAL METHODS
Geophysical prospecting - electrical methods - resistivity, self potential methods - interpretation - application in mineral prospecting - groundwater targeting electrical logging methods in oil exploration.

UNIT III SEISMIC METHODS

UNIT IV MAGNETIC AND GRAVITY METHODS

UNIT V GEOCHEMICAL PROSPECTING
Geochemical prospecting - anomaly - background values - mobility of ions - associated elements - path finder elements - surface indicators - geobotanical methods - application in mineral exploration.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Carryout individual field study using geological mapping techniques.
- Collect, process and analyse data using various geophysical methods
- Explore the subsurface using geophysical methods
- Gain knowledge on geochemical methods
- Do accurate interpretation of data and locate economical ore reserves.

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OBJECTIVES:

- To provide information on natural hazards and their characteristics.
- To teach significance of geology and its effect on disasters.
- To familiarize students with various mitigation methods for natural disasters.

UNIT I INTRODUCTION TO NATURAL DISASTERS 9
Concepts of Disaster, Types of Disaster - Natural Disasters records in India - Earth and its characteristics – Environmental Change and Degradation - Climate Change - Global warming - Disaster cycle: preparedness, response and recovery.

UNIT II EARTHQUAKES AND TSUNAMI 9
Causes of Earthquake and Tsunami - Intensity and Magnitude of earthquakes - Seismic waves and earthquake recording - Seismic zones of India - Seismic codes - Tsunami characteristics and warning systems.

UNIT III LANDSLIDES 9

UNIT IV CYCLONES, FLOODS AND DROUGHTS 9
Severe Weather & Tornadoes - Cyclones, Floods and Droughts - nature and dimensions - Global Patterns - Mitigation & Preparation for floods - Drought Assessment and Monitoring.

UNIT V DISASTER MITIGATION 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:

- Understand the concepts of hazards and disasters
- Have better understanding on geological hazards and climatological hazards
- Comprehend the advanced concepts of hazard mitigation and management
- Gain knowledge on risk assessment and vulnerability mapping due to hazards
- Understand the application of Geospatial and communication technologies in hazard management.

REFERENCES:

AG5012 GROUNDWATER CONTAMINATION

OBJECTIVES:
- To study about the sources of groundwater and its parameters
- To understand various contaminations and its sources.
- To gain knowledge on remediation methods.

UNIT I INTRODUCTION

UNIT II TYPES OF CONTAMINATION
Types – point and non point sources – natural and anthropogenic - organic and poly aromatic compounds – biological – other sources – gasoline spills on the water table - chlorinated solvent spills which sink

UNIT III IDENTIFICATION OF CONTAMINATION
Application of electrical conductivity measurement for soil and groundwater contamination - Application of Ground Penetration Radar and other methods

UNIT IV TRANSPORT PROCESS
Advection, dispassion and diffusion-sorption, biodegradation, transformation, retardation and attenuation of solutes – radionuclide transport

UNIT V REMEDIATION
Waste site characterization-Geochemical modelling-Modeling concepts -Thermodynamics - groundwater quality - Emerging remediation methods, including surfactant and co-solvent soil flushing

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Comprehend groundwater occurrence and its parameters.
- Have better understanding various contaminants of groundwater and their sources
- Use geophysics methods to delineate contaminated sites of soil and groundwater.
- Gain knowledge contaminant transport due to groundwater
- Evaluate and suggest remediation for contaminated sites.
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AG5013 INDUSTRIAL GEOLOGY

OBJECTIVES:
- To study the economic importance of minerals and resources
- To teach mining project evaluation and mineral conservation.
- To provide knowledge on mineral policies and environmental protection.

UNIT I ECONOMICS IN MINERAL EXPLORATION
- Economic Considerations in Mineral Exploration; Systematic approach to Exploration Expenditure; In-situ and Mineable Reserves; Pit Optimization; Bulk Sampling; Pilot Plant Studies; Demand and Price Projections.

UNIT II MINERAL/MINE ECONOMICS AND FINANCE
- Source of Mine Finance; Factors governing profitability; Concepts of Depreciation, Depletion, Present value, Cash Flow and DCF; Costs-Capital, Fixed / variable, Ownership; P & L Account; Balance Sheet.

UNIT III MINERAL PROJECT EVALUATION
- Time Value of Money; Project Evaluation Technique-Pay Back, Discounted Pay Back, DCF, IRR; Project Ranking; Sensitivity analysis; Feasibility study-Prospect and Operating Mines; Preparation of Mine Plan under Mineral Concession Rules.

UNIT IV MINERAL CONSERVATION
- Growth of the awareness; Means of conservation; Limitations in Scope; Wealth from Mineral waste; Co-products and By-products; Substitute for Minerals.

UNIT V MINERAL POLICIES AND ENVIRONMENT
- National Mineral Policy; Prospecting License and Mining Lease; Mines Act, CMR, MMR, Mines Rules, MMRD Act and Rules, EMP, EIA.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the economics involved in mineral exploration
- Have better knowledge on finance and economics of mine operation and production.
- Comprehend mineral project evaluation
- Adopt methods to conserve minerals and resources
- Understand the national mineral policy and environmental assessments.

REFERENCES
4. Bruce, A.K. 1990 Surface Mining, Colorado, Society for Mining, Metallurgy and Exploration, Inc. Published Mines/Minerals Legislations

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AG5014 MARINE GEOLOGY

OBJECTIVES:
- To understand the Ocean features, geological resources, Ocean environment, and Ocean geology.
- To understand the exploration and exploiting methods
- And to understand the various instrumentations and its techniques.

UNIT I PHYSICAL FEATURES OF THE OCEAN
Introduction and scope of Marine Geology; oceanic profile, oceanic features; beaches, coastal classification, erosion and accretion; waves, currents and tides, coastal protection structures

UNIT II OCEANIC CRUST, SEDIMENTS
Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. Ocean sediments, classification, digenesis, Ocean tectonics.

UNIT III OCEAN RESOURCES
Classification of marine mineral deposits. Origin and depositional system of marine resources; beach placers, shelf deposits, deep ocean Phosphatic, Polymetallic nodules, sulfate deposits, hydrocarbon deposits Sea water as a resource.
UNIT IV  OCEANOGRAPHIC INSTRUMENTATIONS  9
Descriptions of research vessels, cruise, position fixing in the sea; sampling devices – Grab
samplers, bottom samplers, dredges, sediment traps, boomerang samplers, water samplers,
Winches, temperature measurement instruments, tools for studying ocean floor topography. POD,
COD, GOD and BOD tools kit.

UNIT V  OCEAN POLLUTION AND LAW OF THE SEA  9
Concept of sea level changes, physical and chemical properties of seawater. Marine pollution-
pathways, residence time, pollutants in the marine environment. Law of the sea, EEZ.
Fundamentals of Remote sensing applications to ocean science.

OUTCOMES:
- Students will understand the physical features of the ocean
- Students will able to understand the morphologic and tectonic domains of the ocean floor
- Students will learn about the various ocean resources
- Students will understand the various oceanographic instrumentations used for marine
  exploration
- Students will able to understand the law of the sea

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   1984.
   Revised edition , 2002

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AG5015  MEDICAL GEOLOGY  L T P C  3 0 0 3

OBJECTIVES:
- To study the chemical constituents of earth materials and their link to health
- To understand various natural toxicants and contaminants.
- To understand various techniques and tools to identify natural toxicity

UNIT I  INTRODUCTION  9
The Foundations of Medical Geology, Geochemical Classification of the Elements, Contributions to
Medical Geology from Public Health and Environmental Medicine, Development of Medical
Geology.

UNIT II  PATHWAYS AND EXPOSURES  9
Volcanic Emissions and Health, Radon in Air and Water, Arsenic in Groundwater and the
Environment, Fluoride in Natural Waters, Water Hardness and Health Effects, Bioavailability of
Elements in Soil, Selenium Deficiency and Toxicity in the Environment, Soils and Iodine
Deficiency.
UNIT III  GEOLOGY HUMAN HEALTH  9
Natural Distribution and Abundance of Elements, Anthropogenic Sources, Uptake of Elements from a Chemical Point of View, Uptake of Elements from a Biological Point of View, Biological Functions of the Elements, Geological Impacts on Nutrition, Biological Responses of Elements

UNIT IV  GEOPATHOLOGY AND TOXICOLOGY  9
Environmental Epidemiology, Environmental Medicine, Environmental Pathology, Toxicology, Speciation of Trace Elements, Geophagy and the Involuntary Ingestion of Soil, Natural Aerosolic Mineral Dusts and Human Health, The Ecology of Soil-borne Human Pathogens, Animals and Medical Geology.

UNIT V  TECHNIQUES AND TOOLS  9
Mapping Geological factors for human health using RS and GIS - Investigating Vector-Borne and Zoonotic Diseases, Mineralogy of Bone, Inorganic and Organic Geochemistry Techniques, Histochemical and Microprobe Analysis in Medical Geology.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the characteristics of natural materials and their link to public health
- Have better understanding on pathways and exposures to natural toxicity
- Appreciate geology and human health relationship.
- Gain knowledge on natural toxicology and geopathology
- Use different techniques to enable probing of diseases in medical geology

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AG5016  MICROPALAEONTOLOGY AND PALYNOLOGY  L T P C
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OBJECTIVES:
- To study the microfossils and their significance for petroleum exploration
- To understand different fauna and flora belong to different environment.
- To teach identification and pollens and spores and their geological application.
UNIT I  INTRODUCTION  9
Introduction to Micropaleontology—scope, use and its applications in oil industries and Paleol-ecology studies. Methodology—separation of microfossils from matrix; mounting technique; identification and classification procedures.

UNIT II  MICROFOSSILS AND ITS APPLICATIONS  9
Study of microfossils from Precambrian—Quaternary; applications—age determination, paleofacies; Interpretation of tectonics from micro faunal evidence.

UNIT III  FORAMINIFERA  9
Foraminifera—Diamorphism, structure and test, classification of foraminifera; distribution through geological ages; ecology of foraminifera. Uses in sequence biostratigraphic studies.

UNIT IV  OSTRACODA  9
Ostracoda—classification, ornamentation, orientation of carapace, microfossils utility-environment significance; marine, non-marine environments and mixed environments.

UNIT V  PALYNOLOGY  9
Introduction—definition, concept, potential and prospects; Palynofossils classification; affinity of spore, pollen, diatoms and dinoflagellate. Maceration technique; general morphology of acritarchs, fungi, stratigraphic importance Palynology in coal and oil exploration.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand scope of microfossils in oil exploration.
- Distinguish and identify various microfossils belonging to foraminifera.
- Identify ostracoda and classify.
- Individually collect and identify microfossils, spores and pollens.
- Gain knowledge on role of spores and pollen in oil exploration.

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OBJECTIVES:
- To provide information on exploration of mineral and ore petroleum deposits,
- To teach methods of ore reserve estimations, mineral economics and feasibility studies,
- To describe mineral processing and beneficiation and national mineral policies.

UNIT I  PRE FEASIBILITY STUDIES  9
Application of Geo Statistics Variogram Range, Kriging -Ore body Optimisation- Bulk Sampling, pilot Plant Saturation Prospecting, Categorisation curve-Block Recovery -grade Vis-à-vis In-situ grade.

UNIT II  MINE MINERAL ECONOMICS  9

UNIT III  MINERAL PROJECT FEASIBILITY  9

UNIT IV  MINERAL PROCESSING/BENEFICIATION  9

UNIT V  MINERAL POLICIES  9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Carryout pre-feasibility studies on mineral prospecting.
- Have better understanding of mine mineral economics
- Evaluate and do feasibility studies for operating mines.
- Gain employment in mineral mining and beneficiation industries
- Carryout strategic studies for sick mineral based industries

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AG5018 MINING GEOLOGY

OBJECTIVES:
- To teach students on surface and underground mining methods
- To teach ore reserve estimation and ore body modeling.
- To teach them mineral prospecting, sampling and drilling techniques.

UNIT I MINERAL EXPLORATION
Triangulation-Establishment of Local Base from National Grid Base-Review of Surface Mapping and Underground Mapping-Different Plans and Sections-Search for ore-Surface and Concealed Guides to ore - Persistence of ore in depth- Preliminary Investigations-Trenching, pitting, Data Interpretation – Drilling from pits.

UNIT II MINERAL PROSPECTING
Macro/Micro Economic Considerations-Sampling – Types-Sampling Quantity-Spacing, Sampling error of Mean-Sample Data Processing-Interpretation-Surface/underground mining terms and definition-Drilling – Core, Diamond Drilling arrangement- Core logging, Compositing- Preparation of Slice Plan-Maximising Drill Data Vis-à-vis Cost of Drilling-Preparation of Assay Plans/Sections - Cut off Grade-Determination of Mineable Limits.

UNIT II ORE RESERVE ESTIMATION
Reserves and Resource – Types and Classification -Geological / Techno economic Considerations in Reserve Classification-Reserve Estimation Methods – Surface and Underground Deposits.

UNIT IV OREBODY MODELLING
Integrating Surface/ Underground mapping-Drilling Sampling to evolve a 3D Model - Fold/Fault Interpretation from Maps and Bore hole Data - GIS Applications in mining and Mineral Projects.

UNIT V SURFACE AND UNDERGROUND MINING METHODS

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Carryout individual mine survey using surveying methods
- Do sampling and prepare slice plan.
- Carryout ore reserve estimation for surface and underground deposits.
- Gain knowledge on surface mining methods
- Understand underground mining methods

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AG5019 NUCLEAR ISOTOPE GEOLOGY

OBJECTIVES:
- To study the radioactive elements and different dating methods
- To understand stable isotopes and their use in Geochronology
- To teach on isotopes and their significance in geological studies.

UNIT I INTRODUCTION AND THE PHYSICS OF THE NUCLEUS
Radioactive Decay - Nucleosynthesis Geochronology, Basics of Radiogenic Isotope Geochemistry, The K-Ca-Ar system - The K-Ar and Rb-Sr systems - The Sm-Nd system - The U-Th-Pb system - The U-Th-Pb system: Zircon dating - U-Th decay series dating - Other decay systems.

UNIT II ISOTOPOES IN GEOCHRONOLOGY

UNIT III STABLE ISOTOPE GEOCHEMISTRY

UNIT IV STABLE ISOTOPES AND APPLICATIONS IN PALAEOCLIMATE STUDY
Paleontology and Archaeology, application to paleoclimatology-deep sea, continental records. The Carbon Cycle. Isotopes, and climate Tree ring studies.

UNIT V CARBON ISOTOPE AND PETROLEUM GEOCHEMISTRY
Sulphur isotopes, diffusion experiments in isotope geology with case studies.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the students expected to be able to:

- Understand the radiogenic isotope geochemistry.
- Have better understanding of isotopes in geochronology
- Appreciate role of stable isotopes in geological studies
- Gain knowledge on stable isotopes and their application for paleoclimate studies
- Understand the role of carbon isotopes in oil exploration

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AG5020 OIL EXPLORATION AND PRODUCTION

OBJECTIVES:
- To teach prospecting methods for oil exploration.
- To teach reserve estimation for oil production
- To provide knowledge on logging and reservoir properties.

UNIT I SEISMIC PROSPECTING

UNIT II RESERVE ESTIMATION AND DRILLING OPERATION
Volumetric oil and gas reserve estimation – proved, probable and possible reserves – Deterministic methods, Three point estimates- Expressing uncertain in the input to volumetric estimation - Rotary Drilling rig components – Basic operations – operational practices and procedures – Drill stem and assembly – descriptions, care, maintenance and handling practices - Drill stem Design – installation of blowout prevention
UNIT III  DRILLING MUD

UNIT IV  CASING AND CEMENTATION
Casing—types, policy, specifications, forces acting—Casing design – preparation of casing to be lowered. Cementation—composition, properties, types, cementation-procedures applications.

UNIT V  WELL LOGGING RESERVOIR ENGINEERING AND PRODUCTION

OUTCOMES:
On completion of this course, the students expected to be able to:

- Understand the seismic method of prospecting for Oil.
- Carryout reserve estimation and understand drilling operations.
- Gain knowledge on drilling mud and its properties.
- Understand procedure involved in casing and cementation
- Comprehend well logging methods and reservoir engineering.

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OBJECTIVES:
- To teach optical properties and identification ore minerals.
- To provide knowledge on geothermometry studies.
- To teach ore mineral beneficiation methods.

UNIT I ORE MICROSCOPY 9
Introduction to ore microscopy – preparation of samples and specimen - mineral identification – examination of optical properties – under reflected light – reflectance measurement of microindentation hardness.

UNIT II ORE FABRICS 9

UNIT III FLUID INCLUSION 9

UNIT IV MINERAL TECHNOLOGY 9
Ore microscopy usage in mineral technology – information from mineralogical studies – mineral dressing processes.

UNIT V MINERAL BENEFICATION 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Identify minerals under reflected light.
- Classify minerals using ore textures and structures.
- Carryout geothermo-metry studies.
- Gain knowledge on mineral dressing processes
- Understand the mineral beneficiation methods.

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OBJECTIVES:
- To teach Origin and formation of hydrocarbons
- To teach on petro physics and tectonic setting.
- To understand depositional systems and biostratigraphy

UNIT I  ORIGIN AND PROCESS OF HYDROCARBON FORMATION  9

UNIT II  PETROPHYSICS AND TECTONIC SETTING  9
Characterization of sediments to its petrophysical nature, diagenesis signatures, porosity, fabric constituents, accommodation, rate of sedimentation, thickness, maturity, basin structure, tectonic history of the sedimentary basins.Interpretation of surface and subsurface stratigraphic units.

UNIT III  GEOPHYSICAL AND GEOCHEMICAL METHODS  9
Seismic method of hydrocarbon reservoir exploration. Seismic profiles interpretation techniques, seismic reflection patterns and to decipher the depositional and structural features.Well logging techniques, interpretation of logs,geochemical parameters; determination of TOM, TOC, VRO, TTI, and TAMR.

UNIT IV  DEPOSITIONAL SYSTEMS AND BIOSTRATIGRAPHY  9

UNIT V  WELL SITE GEOLOGICAL OPERATIONS  9
Well site geological operations; GTO.Well drilling methods, drilling fluids, formation testing, well completion report.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the processes involved in generation, migration and accumulation of oil.
- Have better understanding of petrophysical characteristics of oil and its tectonic setting.
- Perform geophysical and geochemical exploration studies.
- Comprehend biostratigraphy studies and its application in oil exploration
- Perform well site geological operations

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OBJECTIVES:
- To introduce the concepts of planetary science and Geology.
- To provide information on inner planets of the solar system
- To teach planetary remotesensing

UNIT I  INTRODUCTION TO PLANETARY SCIENCE 9
The sun- vital statistics of the sun -Solar system - origin - physics, chemistry, and the surface features of the solid bodies in the solar system; Solar system. -Celestial sphere- the growth of the geocentric system- physical properties of objects in the solar system.

UNIT II  PLANETS 9
Physical properties- optical properties- rotation and magnetic field-surface temperature. Surface features of the terrestrial planets; Inner planets- Geological phenomena- tectonic, volcanic, impact cratering, eolian, fluvial, glacial and possibly lacustrine and marine processes; Outer planets – formation and evolution processes –satellite-characteristic features.

UNIT III  EARTH AND MOON 9
The earth: Planetary evolution- gross properties – solar terrestrial relations- earth in space-interior-geologic process; Moon-origin- basic facts- telescopic studies - internal structure-surface features-environment- surface composition and mineralogy and atmospheric conditions

UNIT IV  ASTEROIDS-METEORITES- COMETS 9
Classification-physical and chemical properties, difference between asteroids-comets- meteoritos-geochemistry- relationship between earth and meteorite geochemistry; satellites- medium, small and tiny their- geology, interior, surface properties, atmosphere and potential for life.

UNIT V  PLANETARY REMOTE SENSING 9
Study of planetary images, and construction of geological maps from orbital images and Rover (insitu); planetary data formats-Missions to - Moon- Mars-Venus- for geological exploration; Lunar return samples – Apollo-Luna.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the students expected to be able to:
- Understand the Planetary science.
- Have better understanding of planets and their geomorphologic features
- Comprehend the knowledge on earth and moon and their properties
- Gain knowledge on asteroids, meteorites and comets
- Understand planetary remote sensing and its applications.

REFERENCES:
3. A.M. Davis 2003. Meteorites, Comets, And Planets, Published by University of Chicago, IL, USA.
AG5024 QUATERNARY GEOLOGY

OBJECTIVES:
- To understand the Quaternary period and types of Quaternary deposits.
- To understand the Quaternary Study Techniques
- And to understand the Causes of Quaternary climate change.

UNIT I QUATERNARY IN INDIA
Definition of Quaternary- Introduction to Quaternary deposits in India—Quaternary Stratigraphy – Oxygen Isotope stratigraphy, biostratigraphy and magnetostratigraphy. Quarternary soil types.

UNIT II CHRONOLOGY OF QUATERNARY SEDIMENTS
Relative chronologies and correlation-use of flora and fauna-non-radioactive techniques, dating methods- radiocarbon, U/Th, Pb-Pb with case studies and dendrochronology.

UNIT III QUATERNARY CLIMATE AND EMERGENCE OF HOMINIDS
Causes of Quaternary climate change-manifestation of Quaternary climate change and current issues in climate change-Human and Quaternary climate change-fauna at the Pliocene-Quaternary transition-emergence of hominids and evolution of Man.

UNIT IV GLACIAL AND INTERGLACIAL CYCLES
Glacial-interglacial cycles-eustatic changes-proxy indicators of paleoenvironmental/ paleoclimatic changes - land, ocean and cryosphere (ice core studies)-Responses of geomorphic systems to climate, sea level and tectonics on variable time.

UNIT V NEOTECTONICS
Tectonic geomorphology, neotectonics, active tectonics and their applications to natural hazard assessment with case studies.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will understand the Quaternary period and types of Quaternary deposits.
- Students will able to understand the dating methods and correlation studies.
- Students will learn about the manifestation of Quaternary climate change and current issues in climate change.
- Students will understand the proxy indicators of paleoenvironmental/ paleoclimatic changes.
- Students will able to understand the Neotectonics and deformation during the Quaternary Period.
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AG5025  SEQUENCE STRATIGRAPHY  L T P C  3 0 0 3

OBJECTIVES:
• To teach the sequence stratigraphy techniques and its applications
• To understand depositional systems and models.
• To teach stratigraphic cycle and biostratigraphic records.

UNIT I  INTRODUCTION  9
Introduction to sequence stratigraphy, scope, applications in exploration of hydrocarbons, stratigraphic terminology, problems and research trends, stratigraphic architecture, facies and sea level cycles.

UNIT II  SEQUENCE STRATIGRAPHY  9
Construction of sequence framework, importance of unconformities, assessing regional and global changes in sea level, areas and volumes of stratigraphic units, hypsometric curves, back stripping, integrated tectonic stratigraphic analysis.

UNIT III  SEQUENCE DEPOSITIONAL MODEL  9
Depositional systems and systems tracts, sequence boundaries, litho-log analysis, sedimentary facies, fossil assemblages, counts and their controls, paleoecology & Milankovitch processes.

UNIT IV  STRATIGRAPHIC CYCLES  9
Types of stratigraphic cycles, tectno-stratigraphic model, Eustasy, epiorogeny, global cycle chart, tectonic mechanisms.

UNIT V  SEQUENCE BIOSTRATIGRAPHY  9
Determination of the biostratigraphic framework, diachroneity of the biostratigraphic record, dating and correlation of stratigraphic events, time in sequence stratigraphy. Applications of sequence bio stratigraphy.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of this course, the students expected to be able to:

- Understand the scope of sequence stratigraphy.
- Construct sequence framework.
- Carryout litho-log analysis and mark sequence boundaries.
- Gain knowledge techno-stratigraphic models
- Understand the sequence biostratigraphy and its applications.

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AG5026 SOIL MECHANICS L T P C
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OBJECTIVES
- To impart knowledge to classify the soil based on index properties
- To assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of strength of soils

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9
UNIT III  STRESS DISTRIBUTION AND SETTLEMENT  
Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Lineland and udl) Use of New marks influence chart – Components of settlement — Immediate and consolidation settlement — Terzaghi’s one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship.

UNIT IV  SHEAR STRENGTH  
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V  SLOPE STABILITY  

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student is expected to be able to

- Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems
- Show the basic understanding of flow through soil medium and its impact of engineering solution
- Understand about the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation
- Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.
- Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

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OBJECTIVES
- To provide the student about the action of radiation on living cells and the response.
- To make the student to understand the basic nuclear medicine physics and newer technology systems.
- To enable the students to understand the diagnostic and therapeutic nuclear medicine techniques.
- To provide a broad knowledge in radiation hazard evaluation and control

UNIT I  BASICS OF NUCLEAR SCIENCE AND RADIATION EFFECTS  9
Radioactivity, nuclear reactions and interaction of ionizing radiation with matter, with emphasis on radiation detection, radiation shielding - photoelectric - Compton effect and pair production - biological effects on human health - Action of radiation on living cells - direct and indirect physical damage - cell response to radiation - somatic and genetic radiation effects - Radiation side effects - Acute and chronic effects of low dose effects.

UNIT II  DIAGNOSTIC APPLICATIONS OF NUCLEAR ENERGY  9
Production of X rays and its applications X-ray radiography - CT scan - contrast studies in x ray imaging - fluoroscopic applications - Mammography - physics of nuclear medicine and nuclear imaging - radio isotopes in diagnosis of nuclear imaging - Tc-99m extraction - radiopharmaceuticals - scanning instruments and techniques.

UNIT III  THERAPEUTIC APPLICATION OF NUCLEAR ENERGY  9
Production of nuclear radiations- alpha, beta and gamma rays and X-rays - External radiation therapy - telecobalt unit and linear accelerators - and internal radiation therapy - Iridium -192 HDR brachtherapy unit- therapeutic nuclear medicine.

UNIT IV  INDUSTRIAL APPLICATIONS OF NUCLEAR ENERGY  9
Industrial applications — Non destructive testing - industrial radiography - tracing, gauging, Radiation sterilization of medical equipments - food preservation and other applications.

UNIT V  NUCLEAR RADIATION SAFETY MEASURES  9
Basic concepts of radiation protection standards - ICRP recommendations - systems of radiological protection - Optimization of protection and individual dos limits - Radiation dose to individuals from natural radioactivity in the environment and man-made sources - Evaluation of external and internal radiation hazards - effect of time, distance and shielding - radioactive waste disposal and transport of radioactive nuclides.

TOTAL: 45 PERIODS

OUTCOMES
After successful completion of the course
- students will be able to handle radioactive source carefully for treatment purpose.
- will develop competence in radioactive waste disposal management
- Will be develop competency to face radiation emergency
- students will develop critical thinking skills in radiation safety and protection.
- will be able to safe guard the radioactive sources used in hospitals.

REFERENCE BOOKS:
OBJECTIVES

- To provide fundamental understanding on smart and intelligent materials.
- To enhance students' understanding on the structure-property relationship.
- To enable students appreciate novel materials and their usage in current cutting edge technologies.

UNIT I BASICS OF SMART MATERIALS AND STRUCTURES 9

UNIT II INTELLIGENT MATERIALS FOR ENERGY GENERATION 9
Artificial Intelligence in Materials, Ferroelectricity: Introduction - Piezoelectric effect, Piezoelectric materials as sensors, Actuators and bimorphs - Transparent Conducting Materials – Band-gap and electrical conductivity, Conditions for transparency – role of defects on conductivity - Applications: Solar cells, Touch screen, etc.

UNIT III SHAPE MEMORY MATERIALS FOR ENERGY STORAGE 9
Introduction to structure types, Structure-property relationships, Shape memory effect (SME), One way and two-way SME, Shape memory alloys (SMAs), Intelligence in the form of SMA, Functional properties of SMAs. Thermal-storage, and aerospace materials. Shape-memory polymers, and their applications.

UNIT IV MULTIFERROIC MATERIALS FOR NOVEL REFRIGERATION 9

UNIT V INTELLIGENT OPTICAL MATERIALS FOR ENVIRONMENT 9

TOTAL: 45 PERIODS

OUTCOMES

- The student will understand the working principle of smart materials.
- The student will get an overview on various types of smart materials and their application areas.
- The student will get ideas to use smart materials in green energy and environment applications.
- The student will get motivated to find novel applications of these multifunctional materials in new technologies.
- The student will get an idea on different synthesis and characterization techniques.

REFERENCES

OBJECTIVES

- To offer a comprehensive approach to reporting of climate change.
- To impart knowledge about political, economic, and ethical questions raised by the need for transformative change of societies in the wake of climate change.
- To reflect over the development of climate change as a nature and a society issue.
- To synthesize knowledge from different areas related to climate change.
- To reflect on the norms and values of journalism in the context of climate change.

UNIT I  HUMAN INFLUENCES

Anthropocene Era (anthropo: man, and cene: new) - Freshwater scarcity - The decline of our oceans, fish, and wildlife - Environmental health - Sustainable energy, agriculture, and food systems – Role and responsibility of journalists – Making climate change relevant as a society issue – Politics and economics of climate change – Environmental ethics – Human health – Species migration.

UNIT II  PUBLIC NARRATIVES

Complex science and uncertainty - Public apathy and politics - Well-funded counter-narratives - Zealous stakeholders - What can (incorrectly) appear due to a lack of news hook for stories - Two centuries of CO₂ emissions.

UNIT III  JOURNALISTIC CHALLENGES

Environmental Journalism as a craft - Roles and differences between journalism and communications – Finding the most accurate, credible and timeliest information on science and issues – Essentials of environmental reporting – Discerning uncompromised expert sources – Using human narratives and descriptive storytelling to relate real-world impact – Tapping the databases, records and other tools commonly used by environmental reporters.

UNIT IV  CLIMATE ISSUES

The lack of diversity in environmental journalism – “Junk science” – Battling climate denial - Covering GMOs – The problem of doomsday climate reporting – Digital security for journalists and researchers etc.

UNIT V  JOURNALISTIC SKILLS

Hands-on journalistic series – Reporting, developing, funding, crafting and publishing environmental stories – Writing diverse stories on environmental history, a wildlife or ocean story, a clam-aquaculture story, a work of nature writing, etc. – A polished, fact-checked, final story with questions answered and edits made from the first draft and at least two added elements such as photos, audio or video clips, graphics, timelines or others to draw people in.

TOTAL: 45 PERIODS

OUTCOMES

- Students will understand the importance of climate issues.
- Students will understand the various aspects of climate change and its effect in society.
- Students will learn to cover the climate change issues.
- Students will understand the need of journalistic skills for covering climate issues.
- Students will learn the various strategies, approaches on covering climate issues in various media.

REFERENCES


EA5492 DIGITAL PHOTOGRAPHY

OBJECTIVES

- To create opportunities for professional and creative expression through the practice and art of photography.
- To inculcate aesthetic sense involved in creativity.
- To get to know the genres of photography

UNIT I CAMERA


UNIT II LENS AND ELEMENTS OF PHOTOGRAPHY

Different type of Lenses - Basic Shots and Camera Angles, Photographic Composition - View point and Camera angle-Eye Level, Low and High, Balance- Aspects of Balancing, Shapes and Lines, Pattern, Volume, Lighting, Texture, Tone, Contrast- and Colour, Framing, various Perspectives.

UNIT III COLOUR AND LIGHTING

Colour Theory, Colour Temperature, Electromagnetic spectrum, Lighting Philosophies – Basic styles of Lighting – Properties of Light – Additive and Subtractive Light – Contrast and Lighting Ratios – Direct and Indirect Light – Three point and Five Point Lighting – Light Sources. Light meters and filters

UNIT IV PEOPLE AND PORTRAIT PHOTOGRAPHY

Indoor and outdoor lighting techniques for portraits, the Casual Portrait, Environmental Portraits, Group Portraits, Familiar Subjects, Hands and Other Details.

UNIT V GENRES OF PHOTOGRAPHY

Basic shooting and Lighting Techniques and Equipments required for different genres of Photography like Black and White, Landscape, Cityscape, Architecture, Advertising, Table top photography Fashion, Food, Automobile, Sports, Travel, Children, Portrait, wild life, Still Life, Event, Silhouette, Festival and Themes.

TOTAL: 45 PERIODS

OUTCOMES

- Students will be able to utilize the principles of good composition in photography.
- Students will be able to develop an individual style in representing the society through photographs.
- Students will have a thorough understanding of how to create visual variety
- Students will understand the foundation principles of design
- Students will gain understanding in Depth of field
- Students will understand the different genres of photography

REFERENCES

OBJECTIVES
- To introduce the basic concept and principles of green chemistry for environmental management.
- To make the students know about green reagents and its importance to the environment.
- To acquaint the student with green solvents and its impacts in green chemistry.
- To familiarize the synthesis of materials using green methods.
- To impart the knowledge on applications of green synthesis technology.

UNIT I PRINCIPLES OF GREEN CHEMISTRY

UNIT II GREEN REAGENTS AND CATALYSTS
Choice of starting materials – reagents (Dimethyl carbonate, polymer supported reagents) – catalysts (microencapsulated Lewis acids, zeolites, basic catalysts polymer supported catalysts, introduction to biocatalysts).

UNIT III GREEN SOLVENTS
Aqueous phase reactions (Claisen rearrangement, Aldol condensation, wurtz reaction, reduction of carbon carbon double bond, oxidation of amines into nitro compounds – Electrochemical synthesis (synthesis of adiponitrile) - Ionic liquids – reactions in acidic ionic liquids- reactions in neutral ionic liquids (hydrogenations, diels-Alder reactions, Heck reactions, O-alkylation and N-alkylation, methylene insertion reactions).

UNIT IV GREEN SYNTHESSES
Microwave induced green synthesis (Hoffmann Elimination and Oxidation of alcohols) – Ultrasound assisted green synthesis (Esterification, Saponification and Cannizaro reaction) – Solid state green synthesis (Dehydration of alcohols to alkenes, Grignard reaction)- Solid supported organic synthesis (Synthesis of furans and pyrrole).

UNIT V APPLICATIONS OF GREEN SYNTHESIS

TOTAL: 45 PERIODS

OUTCOMES
- To be familiar with basic concepts of green chemistry and apply to them in various fields.
- To recognize the catalytic reaction with green reagents and its importance. To identify available green solvents and apply them to various synthesis process.
- To recognize the preparations of materials with green process and its application to the environment.
- To gain the knowledge of preparation of various drugs using green synthesis methods.
- To be have the skills and technology towards green chemistry and apply in industry.
AC5492 FOOD CHEMISTRY L T P C 3 0 0 3

OBJECTIVES
- To enable the students to acquire knowledge on the macro and micro constituents of the food
- To know the structure and chemical characteristics of constituents of food.
- To demonstrate the knowledge of food chemistry and applying, the principles and concepts of chemistry as they apply to food systems.
- To familiarize the student with the relationship between water and food.
- To explain the rationale for certain food processes and preservation

UNIT I INTRODUCTION TO FOOD AND ITS PROPERTIES 12
Proteins-Enzymes- Chemistry and structure, kinetics, Maillard reaction. Food carbohydrates: Structural, nutritional and functional aspects. Emulsifiers-role of emulsifiers selection of emulsifier based on hydrophilic and Lipophilic balance (HLB) and its application. Thickeners-definition, chemical structure, gel formation, list of permitted thickeners and food application. Chemical and biochemical changes: changes occur in foods during different processing.

UNIT II PROCESSING AND PRESERVATION 12
Scope and benefits of industrial food preservation. Preservation of foods by chemicals, antibodies, antioxidants, salt and sugar. Principles of food freezing: freezing point of foods Psychrometric chart, Freeze concentration, freeze drying, IQF. Nanotechnology: Principles and application in foods, Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

UNIT III FLAVOURS AND COLOURING AGENTS 9
Chemistry of food flavor, definitions, Flavourmatics /flavouring compounds, flavor retention-off flavours and food taints. Colour -Natural and synthetic food colours, their chemical structure, stability, permitted list of colours, usage levels and food application.

UNIT IV WATER RELATIONS IN FOOD 6
Moisture in food: Structure, properties, Types of water in food and their specific function water activity and stability.

UNIT V FOOD ADDITIVES 6
Definitions, uses and functions of: Acids, Bases, Buffer system, chelating/sequestering agents, Antioxidants, Anti-caking agents, Firming agents. Flour bleating agents and Bread improvers. Anti-microbial agents/ class I & II.

TOTAL: 45 PERIODS

OUTCOMES
- Will know about the factors governing the food quality and chemical constituents.
- Will be able to name and describe the general chemical structures of the major components of foods and selected minor components
- Will come to know about the techniques involved in food processing and preservation
- Will be acquitted with food additives and their function in preservation
- Will be familiarize with the nature of packed food from industrial processes

REFERENCES

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
REFERENCES

AG5491  NATURAL HAZARDS AND MANAGEMENT  L T P C
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OBJECTIVES
- To teach characteristics of natural hazards.
- To teach mitigation methods for natural hazards.
- To provide knowledge on assessment and management of natural hazards.

UNIT I  DISASTER PHENOMENON
Disaster threat - characteristics-parameters – mapping aspects for earthquake, landslides, tsunami, cyclones, flood, drought and epidemics.

UNIT II  MITIGATION

UNIT III  ASSESSMENT

UNIT IV  MANAGEMENT

UNIT V  CASE STUDIES AND ADVANCED TOOLS
Post disaster review – role of remote sensing and GIS – National and state level case studies on various disasters.

TOTAL: 45 PERIODS

OUTCOMES
On completion of this course, the students expected to be able to:
- Gain knowledge on natural hazards and their characteristics
- Have better understanding on geological and hydrological hazards
- Appreciate various mitigation techniques.
- Carryout risk assessment and vulnerability mapping
- Understand the role of remote sensing and GIS in natural hazard risk reduction.

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AG5492 OCEAN RESOURCES AND EXPLORATION TECHNIQUES

OBJECTIVES

- To understand the sources of Marine Minerals.
- To understand the various energy resources pertain to marine system.
- To understand the importance and economic aspects of marine minerals.

UNIT I INTRODUCTION


UNIT II OCEAN RESOURCES


UNIT III ENERGY RESOURCES


UNIT IV OCEAN RESOURCE EXPLORATION AND EXPLOITATION

Marine sampling - Water Samplers - Bottom Samplers - Instrumentation.

UNIT V OCEAN MINERAL MINING


TOTAL: 45 PERIODS

OUTCOMES

- Students will understand the various sources of marine minerals.
- Students will able to understand the Mineral deposits derived from land sources.
- Students will learn about the energy resources of marine system.
- Students will learn about various sampling methods and instrumentation.
- Students will able to understand the economic aspects of marine minerals.
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**MC5491 BASIC CRYSTALLOGRAPHY AND CRYSTAL GROWTH**

**OBJECTIVES**
- To introduce the basics of crystal symmetry and crystal structures.
- To provide students with a background to X-ray generation and detection
- To provide instruction on the steps involved in single crystal structure determination
- To teach the concept of powder X-ray diffraction and its applications
- To teach various crystal growth techniques

**UNIT I CRYSTAL SYMMETRY AND STRUCTURES**

**UNIT II X-RAYS**
X-rays - generation of X-rays - sealed tube and rotating anode generators – synchrotron radiation – continuous and characteristic X-rays - X-ray absorption – X-ray monochromators – collimation – Soller slits - X-ray detectors (principles only)

**UNIT III SINGLE CRYSTAL STRUCTURE DETERMINATION**
UNIT IV  POWDER X-RAY DIFFRACTION  9

UNIT V  CRYSTAL GROWTH TECHNIQUES  9

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of the course the students will
• understand crystal symmetry, crystal planes and simple crystal structures
• gain a knowledge of X-ray generation, absorption, monochromatization and detection
• get a working knowledge of single crystal structure determination
• get some insight into the powder diffraction and its applications
• be able to understand the basics of various crystal growth techniques

REFERENCES

MC5492  NONLINEAR SCIENCE  L T P C
3 0 0 3

OBJECTIVES
• The students will be introduced to the basics of nonlinear dynamics and its applications.
• The students will learn about the mathematical models needed to study the concepts of fixed points, oscillations, bifurcations and integrability.
• The students will know about the nonlinear dynamical phenomena in chemical systems.
• The students will understand the importance of nonlinear dynamics in biological systems.
• The students will be introduced to the concepts of nonlinear dynamical analysis in geological systems.

UNIT I  NONLINEAR DYNAMICS  9

UNIT II  MATHEMATICAL MODELS  9
First-order differential equations - separation of variables - slope fields - Euler’s method - equilibria and phase plane - bifurcations - higher-order equations - trace-determinant plane - harmonic oscillators - equilibrium point analysis - non-autonomous systems and chaos - finite dimensional integrable systems - dispersive systems - solitary waves - solitons - analysis of soliton solutions.
UNIT III CHEMICAL SYSTEMS

UNIT IV BIOLOGICAL SYSTEMS

UNIT V GEOLOGICAL SYSTEMS

OUTCOMES
After completing this course, the students should able to.
- Understand the basics of nonlinear dynamics and its applications.
- Gain knowledge on the concepts of fixed points, oscillations, bifurcations and integrability.
- Appreciate the importance of nonlinear dynamical phenomena in chemical systems.
- Understand the role of nonlinear dynamics in biological systems.
- Apply nonlinear dynamical analysis for geological systems.

REFERENCES

MT5491 STATISTICAL METHODS L T P C
3 0 0 3

OBJECTIVES
- To organize and describe the data and hence compute the various descriptive measures
- To give an idea of testing the statistical hypothesis claimed based on a set of data points using standard sampling distributions
- To expose to the basic principles of experimental design and hence carry out the analysis of variance
- To use non parametric methods on data sets which are not from normally distributed population
- To prepare the students to implement the various concepts in statistics using R statistical tool
UNIT I   DESCRIPTIVE STATISTICS  
Frequency distribution - Graphs of frequency distribution - Descriptive Measures - Quartiles and Percentiles - Calculation of sample mean and population mean

UNIT II   HYPOTHESIS TESTING  
Sampling Distributions- Central Limit Theorem - Testing a Statistical Hypothesis - Tests Concerning Means and variances - Independence of Attributes - Goodness of Fit

UNIT IV   ANALYSIS OF VARIANCES  
One way and two way classification - Completely Randomized Design - Randomized Block Design - Latin Square Design

UNIT V   NONPARAMETRIC METHODS  
Sign Test - Wilcoxon's Signed Rank Test - Rank Sum Tests - Tests of Randomness - Kolmogrov Smirnov and Anderson Darling Tests

UNIT V   CALCULATIONS USING R  

TOTAL: 45 PERIODS

OUTCOMES
- It equips the student to compute mean, variances, quartiles and percentiles for a large set of data points obtained from a series of measurements
- It imparts the knowledge of various test statistics used in hypothesis testing for mean and variances of large and small samples
- It enables the students to compare several means
- It makes the students use sign test and rank test which can be applied to any raw data without the underlying assumptions that the observations are from normal population.
- It equips the students to implement the various concepts learnt using R tool for statistics

REFERENCES

HS5491   PROFESSIONAL EMAIL COMMUNICATION
UNIT I   Email as a medium of professional communication (1 hour)
   a. Clear, grammatically correct sentences
   b. Clear and coherent paragraphs
   c. Polite and professional expression
   d. Accurate punctuation

The nature of the e-mail in its present technological state
   a. The pros and cons of using email for professional communication
UNIT II Standard email conventions and etiquette  
  a. Conventions for effective emailing intra and inter workplaces (inclusive of formatting)  
  b. Interpersonal etiquette to be used in professional emailing  
  c. Cross-cultural dos and don’ts when using email across borders  

UNIT III Understanding email messages accurately (2 hours) 
  a. Understanding the core message  
  b. Understanding the writer’s intention and expectation accurately  
  c. Interpreting the style and tone of the message  
  d. Reading and understanding messages quickly  

UNIT IV Writing clear and contextually appropriate responses (12 hours)  
  a. Writing appropriate opening and closing sentences  
  b. Structuring the email logically and coherently  
  c. Positioning the core message for reader attention and action  
  d. Writing messages for a range of professional functions such as giving an update, reporting, requesting, clarifying and confirming, giving instructions etc.  

UNIT V Using a range of professional styles (10 hours)  
  a. Maintaining courtesy and professional poise in all messages  
  b. Being direct or indirect as necessary  
  c. Being elaborate or brief as necessary  
  d. Being assertive and decisive when needed  

Learning outcome: At the end of the course, the students should  
  - Understand email as a professional communication medium and as it is used in workplaces today.  
  - Use standard e-mailing conventions and etiquette used in workplaces internationally.  
  - Use appropriate style and tone for communicating a variety of professional messages that are generally communicated via e-mail in work and business communication.  
  - Read and interpret e-mail messages accurately and write contextually appropriate responses.  
  - Use English accurately while writing emails in generic professional contexts.  
  - Use punctuation accurately while writing e-mail messages.  

    Assessment (with individualised feedback for mid-course tests):  
    - Mid-course Assessment - 1 hour + 1 hour for feedback after evaluation  
    - Mid-course Assessment - 2 (1 hour + 1 hour for feedback after evaluation)  
    - Final Assessment – 2 hours (inclusive of Email English test)  

Classroom teaching methodology: Concept familiarisation will be accompanied with practice in generic professional emailing contexts. Practice tests and individualised feedback will be used feedback.  

Material for the course will be teacher generated
OBJECTIVES
The Course aims to,
- Develop the project writing skills of engineering graduates
- Give engineering and technology students practice in writing a project report
- Enhance their awareness on the importance of report writing in the professional context

UNIT I

UNIT II

UNIT III
Structure of the Project Report: (Part 1)Framing a Title – Content – Acknowledgement – Funding Details -Abstract – Introduction – Aim of the Study – Background - Writing the research question - Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework

UNIT IV
Structure of the Project Report: (Part 2) – Literature Review, Research Design, Methods of Data Collection - Tools and Procedures - Data Analysis - Interpretation - Findings -Limitations - Recommendations – Conclusion – Bibliography

UNIT V
Proof reading a report – Avoiding Typographical Errors – Bibliography in required Format – Font – Spacing – Checking Tables and Illustrations – Presenting a Report orally – Techniques

OUTCOMES
At the end of the course students will be able to,
- Write reports successfully
- Analyze issues threadbare and arrive at findings based on the analysis
- Write reports for different purposes

REFERENCE BOOKS

OBJECTIVES
The course aims to,
- Develop public speaking skills among students of engineering and technology
- Enhance the presentation skills of students
- Heighten the awareness related to the fundamentals of presentations
UNIT I
Presentation skills – Characteristics of an effective Oral Presentation – Audience - Context, Content, Speaker Status - Purpose – Modus Operandi – Extempore

UNIT II
Emphasis on syllable stress, pronunciation, intonation, pauses, pace - Preparation for a presentation – Avoiding plagiarism –Ample use of Referencing skills – Efficient ways of Collecting and Collating data (due emphasis on important information)

UNIT III

UNIT IV

UNIT V
Presentation skills – Guidelines – Group Presentation - Creative approaches to presenting – Technical presentation - Speaking under time constraint – variations in pitch, tone & intonation - Credibility in presentation (Use of authentic data/information) Podium panache – Effective Delivery

Learning Outcomes: At the end of the course, students will be able to,

TOTAL: 45 PERIODS

REFERENCE BOOKS

AUDIT COURSES (AC)
AX5091 ENGLISH FOR RESEARCH PAPER WRITING L T P C 2 0 0 0

OBJECTIVES
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission
UNIT I  INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II  PRESENTATION SKILLS 6

UNIT III  TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV  RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V  VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

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AX5092  DISASTER MANAGEMENT  L T P C
2 0 0 0

OBJECTIVES
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches
UNIT I  INTRODUCTION  6
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II  REPERCUSSIONS OF DISASTERS AND HAZARDS  6

UNIT III  DISASTER PRONE AREAS IN INDIA  6
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV  DISASTER PREPAREDNESS AND MANAGEMENT  6
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V  RISK ASSESSMENT  6
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

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OBJECTIVES
- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS 6
Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES 6
Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS 6
Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE 6
Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES
- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

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1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

AX5094 VALUE EDUCATION L T P C 2 0 0 0

OBJECTIVES
Students will be able to
- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

84
UNIT I

UNIT II

UNIT III

UNIT IV

OUTCOMES
Students will be able to:
- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

SUGGESTED READING

AX5095 CONSTITUTION OF INDIA

OBJECTIVES
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION:
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION:
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:
UNIT IV    ORGANS OF GOVERNANCE:
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, 
President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges,
Qualifications, Powers and Functions.

UNIT V    LOCAL ADMINISTRATION:
District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role
of Elected Representative, CEO, Municipal Corporation, Panchayati raj: Introduction, PRI: Zila
Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level:
Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed
officials, Importance of grass root democracy.

UNIT VI    ELECTION COMMISSION:
Election Commission: Role and Functioning, Chief Election Commissioner and Election
Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
• Discuss the growth of the demand for civil rights in India for the bulk of Indians before the 
  arrival of Gandhi in Indian politics.
• Discuss the intellectual origins of the framework of argument that informed the
  conceptualization
• of social reforms leading to revolution in India.
• Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] 
  under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct
  elections through adult suffrage in the Indian Constitution.
• Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India,1950(Bare Act),Government Publication.

AX5096         PEDAGOGY STUDIES          L T P C
               2 0 0 0

OBJECTIVES
Students will be able to:
• Review existing evidence on there view topic to inform programme design and policy
• Making under taken by the DfID, other agencies and researchers.
• Identify critical evidence gaps to guide the development.

UNIT I     INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of
learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview
of methodology and Searching.
UNIT II       THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III       EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV       PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V       RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to understand:
• What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
• What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
• How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

AX5097       STRESS MANAGEMENT BY YOGA

OBJECTIVES
• To achieve overall health of body and mind
• To overcome stress

UNIT I
Definitions of Eight parts of yoga.(Ashtanga)
UNIT II
Yam and Niyam - Do’s and Don’ts in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects - Types of pranayam

OUTCOMES
Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING
1. ‘Yogic Asanas for Group Tarning-Part-I”-Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AX5098 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

OBJECTIVES
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses-29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (don’t’s) - Verses-71,73,75,78 (do’s)

UNIT II
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

OUTCOMES
Students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and man kind to peace and prosperity
- Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi,2010