

SYLLABUS OF COURSE WORK OF PH.D(Sc.)

DEPARTMENT OF GEOLOGICAL SCS.

Courses	Subject	Full Marls
Compulsory Units	A. Research Methodology	50
	B. Review of Research Work	50
Elective Units	01. Exploration Geophysics	50
	02. Geophysical (geoelectric) method for mineral and ground water Investigation	50
	03. Application of Remote Sensing and GIS Techniques in Ground water Exploration	50
	04. Geodynamics	50
	05. Petrography in Structural Geology	50
	06. Gemmology	50
	07. Sedimentary basin analysis	50
	08. Stratigraphic Correlation Techniques	50
	09. Textural modeling -- a tool for petrogenesis of igneous and Metamorphic rocks.	50
	10. SEDEX process with particular emphasis on Fe-Mn ore deposits.	50
	11. Reading seminar in the subject of ore deposits related to igneous Systems.	50
	12. Platinum group of elements: a key tracer of Earth's interior	50
	13. Basic techniques of numerical modeling in Structural Geology and Tectonics	50
	14. Use of Meso- and Micro-scale structures in structural analysis.	50
	15. Carbonates through ages – its physical, chemical & biological perspectives	50
16. Sequence stratigraphy in the light of basin evolution	50	
17. Geochemistry of hydrothermal ore deposits – theoretical & practical aspects	50	

N.B. : Students to opt for any 2 elective units out of the elective units offered. 32X2 classes to be attended.

COMPULSORY UNITS

A. Research Methodology:

Definition of problem : Necessity of defining problem, Technique involved in defining a problem. Surveying the available literature.

Techniques involved in solving the problem: Different methods used to solve a problem.

Research Design: Subject of study; Place of study; Reason of such study; Type of data required; Method of data collection; Periods of study; Style of data presentation.

Developing a research plan: Research objective; Informations required for solving the problem; Each major concept should be defined in operational terms; An overall description of the approach should be given and assumption if considered should be clearly mentioned in research plan; The details of techniques to be adopted.

Methods of data collection: Experimental methods.

Analysis of data: Various measures of relationship often used in research studies, Correlation coefficients.

Chi-Square test: Definition of chi-square test. Significance in Statistical analysis.

Computer:

Basic of Computer Operating System: Using Windows – Directory structures – command structure (Document preparation, EXCEL, Power Point Presentation).

Word Processing: Basics of Editing and Word processing.

Numerical analysis.

Figure Plotting: Figure insertions in documents.

Web Browsing for Research: Usage of Webs as a tool for scientific literature survey.

Error Analysis: Basics of a measurement and its interpretation, mean, standard deviation, variance, correlation coefficient; Usage of packages (e.g. ORIGIN; EXCEL) for data analysis.

Curve Fitting: Linear and Non-linear fitting of data.

B. Review of Research Work:

The relevance of the research work from the perspective of the subject – Possible ways to apply the research work in future.

ELECTIVE UNITS

UNIT No. 01 : Exploration Geophysics :

Different Geophysical Methods --- Principles, Mathematical Derivations, Interpretational Procedures, Instrumentation and Field Studies & its Interpretation.

UNIT No. 02: Geophysical (geoelectric) method for mineral and ground water

Investigation:

D.C. Resistivity profiling and sound principles, Mathematical Derivations, Instrumentations, Field Procedures & Applications for Minerals and Ground Water investigations.

UNIT No. 03: Application of Remote Sensing and GIS Techniques in Ground Water

Exploration:

Introduction, Hydrogeochemistry, Ground water Pollution, Remote Sensing & GIS, Ground Water Geophysics, Well Hydraulics & Water Well Construction, Ground Water Provinces, Environmental Impact Analysis, Artificial Recharge – Monitoring & Assessment, Ground Water Management, Treatment of Ground Water, Urban Hydrology, Ground Water Modeling and Rural water Supply.

UNIT No. 04: Geodynamics:

Earth's lithosphere, Physical properties of Mantle rocks and minerals, Thermo-mechanical Instability of the Mantle, Gravity driven Geodynamic processes, Core Dynamics.

Unit No. 05: Petrography in Structural Geology:

Preparation of Petrographic thin sections, Analysis of Tectonic Fabric, Analysis of micro-scale structure, Deformation Mechanism, Relation between Deformation and Crystallization, Shear zone Rocks.

UNIT NO. 06: Gemmology:

Genesis, classification, physical & optical characteristics, etc.

UNIT No. 07: Sedimentary basin analysis:

Definition, Methodology of Analysis, Identification of various facies assemblages, Pattern of Sedimentation, Petrographical implications in Basin Analysis, Case studies

UNIT No 08: Stratigraphic Correlation Techniques:

Need for correlation, Different correlation techniques and related methodologies, relationship with evolutionary history of life, statistical analysis.

UNIT No. 09: Textural modeling ----- a tool for petrogenesis of igneous and Metamorphic rocks.:

Classical and advanced Techniques for Textural Analysis, Nucleation and growth of materials in Magmatic and Metamorphic Systems, Role of deformation on formation of Texture, Equilibrium and non-equilibrium textures and their Significance, modeling igneous and metamorphic textures to recover p-T-t history of rocks and melts.

UNIT No. 10: SEDEX process with particular emphasis on Fe-Mn ore deposits: Definition, Type of deposit and classification, Factors controlling the process, Genetic Model, Sources of elements, Specific examples.

UNIT No. 11: Reading seminar in the subject of ore deposits related to igneous Systems:

The participants will read some key and fundamental papers in the subject of ore deposits related to igneous system, especially in the field of chromite, platinum group elements (PGE) and Ni-Cu-sulfide deposits. The course will focus on extensive reading of scientific articles plus discussion to have a deeper understanding of the crystal-melt equilibria that controls fundamental processes of magmatic ore deposits.

UNIT No. 12: Platinum group of elements: a key tracer of Earth's interior:

Geochemistry of noble metals (Os, Ir, Rh, Ru, Pt, Pd and Re) provides unique clues to the early origins of our planet. How noble metals are distributed within the Earth is the subject of intense debate. The relative effects of different processes can be assessed using PGE-patterns as well as Os isotopic systematics of the mantle materials. In this particular course basic geochemical characters of the PGEs; their fractionation, and the fundamental processes involved in the fractionation will be discussed. In addition, the use of PGE geochemistry to understand the chemical evolution of the Earth's mantle will be a significant component of this course.

UNIT No. 13: Basic techniques of numerical modeling in Structural Geology and Tectonics:

Fundamental Concept and basis of Numerical Modeling, Physical theories of Geological situations and Modeling Equations, mathematical and Numerical Techniques, Use of different softwares like MS Excel, Visual Basic, Ansys for Numerical Modeling.

UNIT No. 14: Use of Meso- and Micro-scale structures in structural analysis :

Identification of different small scale geological structures in outcrop and under microscope, Collection of data, plotting of structural elements, Basis of analysis, Process of reconstruction of evolutionary history.

UNIT No 15: Carbonates through ages – its physical, chemical & biological perspectives :

Distribution and distinction of carbonate deposits in rock record. Distinctions between Precambrian and Phanerozoic Carbonate deposit. Physico-chemical and biological control on carbonate deposition in Precambrian and Phanerozoic sequence. Isotopic signatures of carbonate deposits.

UNIT No. 16: Sequence stratigraphy in the light of basin evolution :

Understanding basin forming processes and basin architecture. Stratigraphic Signature of a basin: Sea level change, Basin-floor wobbling, Sedimentation rate and climate. Depositional facies, Seismic Facies Seismic Expression & Configuration and log-based Sequence, Correlation Sequence, Stratigraphic Principles & Facies Tracts Carbonate Sequence Stratigraphy and Drowning Unconformity. Application of sequence stratigraphy to basin evolution

UNIT No 17: Geochemistry of hydrothermal ore deposits – theoretical & practical aspects:

Sources of hydrothermal components (metals, fluids); Hydrothermal alteration and ore mineralization; Metal transport by hydrothermal fluids; Stable isotope systematic of hydrothermal ore minerals and gangue minerals; Fluid inclusions studies of hydrothermal ore deposits; Microthermometric freezing-heating experiments of fluid inclusions.

Course Name: ADVANCED STRUCTURAL GEOLOGY

Marks: 50

Duration: One Semester

Course content:

- **Rock mechanics:** force, strain and stress (including Mohr diagram and strain analysis methods)
 - **Experimental rock deformation tests and failure criteria:** uniaxial and triaxial, compressive test, tensile test
 - **Ductile and Brittle rock deformation:** simple shear and pure shear, deformation modes and mechanisms, brittle-ductile transition, shear zone, faulting (including fault rock development, palaeostress analysis from fault slip data) and fracturing (including joint development) in the upper crust
 - **Role of fluids:** fluid pressure and fluid flow
 - **Advanced techniques in structural geology:** meso to micro scale
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Environmental Micropaleontology (50 Marks)

History of micropaleontology and its position in the context of the natural sciences. Overview of the systematic, biology and ecology of major microfossil groups including foraminifera, radiolarians, diatoms, dinoflagellates, calcareous nannofossils and acritarchs.

Detailed study of foraminifera-preparation and research techniques, taphonomic aspects, applications to palaeoecology, environmental monitoring and palaeo-oceanography, geochemistry of tests and transfer function, distribution in polar regions and mangroves their stratigraphic significance.

Course Name: Shear zone pattern and granite emplacement

Marks: 50

Course content: Types of Shear zone pattern, mechanism of granite emplacement in both compression and extensional regime of a shear zone, distinguishing field and microscopic features of granite emplacement in relation to the formation of different shear zones.