

# NATIONAL COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620 001

Nationally Re accredited at 'A' Grade by NAAC

## M. Phil. Geology [Full Time]

Choice Based Credit System

(Applicable to the candidates admitted from the academic year 2016-17 onwards)

### Course Pattern

| SEMESTER | COURSE                  | TITLE OF THE PAPER                                      | CREDITS | INTERNAL MARKS | EXTERNAL MARKS | TOTAL |
|----------|-------------------------|---|---------|----------------|----------------|-------|
| 1        | M16GY1                  | RESEARCH METHODOLOGY & EDUCATION TECHNOLOGY             | 4       | 40             | 60             | 100   |
|          | M16GY2                  | RECENT TRENDS IN GEOLOGY                                | 4       | 40             | 60             | 100   |
|          | M16GY3                  | INSTRUMENTATION TECHNIQUES AND DATA ANALYSIS IN GEOLOGY | 4       | 40             | 60             | 100   |
|          | M16GY4<br>(GUIDE PAPER) | HYDROGEOLOGY AND GROUNDWATER MANAGEMENT                 | 4       | 40             | 60             | 100   |
|          | M.PHIL DISSERTATION     |   | 8       | 150            | 50             | 200   |
|          | TOTAL                   |   | 24      |                |                | 600   |

## COURSE I

### M16GY1 RESEARCH METHODOLOGY & EDUCATION TECHNOLOGY

#### RESEARCH METHODOLOGY (UNIT I to III)

##### UNIT I

###### **Research – An Introduction**

Definition of Problem: Necessity of defining the research problem - Technique involved in defining a problem - Objectives, approaches - planning or design- methods of research; Literature survey - Techniques involved in solving the problem: Different methods used to solve a problem.

Research Design: Subject, Reason & Place of study – Types - Method of collection - Periods of data - Style of data presentation.

Developing a Research Plan & Objective: Information 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.

##### UNIT II

###### **Methods of Data Collection and Software Execution**

Methods of Data Collection: Experimental methods.

Analysis of data: Data Analysis - Various measures of relationship often used in research studies.

Review of Research Work: The relevance of the research work from the perspective of the subject – Library research and preparation of research report - Use of Libraries and information retrieval systems - Use of abstracts – Abstraction - Preparation of index cards - Methods of editing.

Preparation of Manuscript: title - introduction - Review of Literature-objectives and purposes of Experimental Methods - Results, tables and figures - Discussion - References - Style of Writing.

Field methods of geological investigations - Preparation of Field Reports - Possible ways to apply the research work in future.

##### UNIT III

**Geoscientific Writing:** The Writing Process - Stages of Writing – Planning Generating ideas - Stating the thesis - Organizing ideas – Drafting - Writer’s block. The three don’ts of drafting - Rewriting - Revising and Self - editing.

Designing Illustrations: Tables – Figures – Graphs – Charts – Photographs - Geoscientific maps and General Guidelines for Illustrations.

Documenting Information Sources: Citation Methods - Parenthetical References - List of References – Notes - Documenting Styles - Documenting Print Sources – Elements of Citation - Citing In-text References – Documenting - Electronic Sources - List of References.

## **EDUCATION TECHNOLOGY (UNIT IV & V)**

### **UNIT IV**

Origin, history - meaning and definitions of Educational Technology - Objectives, forms and approaches - Scope, significance and use of educational technology - System concept - Types - Parameters - Steps involved in system approach - Education system - Instructional system.

### **UNIT V**

Meaning of Information and Communication Technology (ICT) - Definition - features - trends - Uses and limitations - Characterizes of e-learning - Advantages and limitations - Integration of ICT in teaching and learning - ICT applications: using word processors, spread sheets, power point slides in the class room - ICT for research: on - line journals, e-books, technical reports, theses and dissertations - computer mediated teaching: Multimedia, e-content.

### **REFERENCES**

- Kothari, C. R., 2004, Research methodology methods and techniques, *Wishwa Prakashan*
- Srinivasa Rao, K., 2004, Geoscientific writing - A Guide to language and composition styles, Memoir, *Geo. Soc India*, Bangalore.
- Robert, R. Compton., 1968, Manual of field geology, *Wiley Eastern Pvt. Ltd.*, New Delhi - 5.
- Lahee F.H Field Geology, *CBS Publishers & Distributors*.
- Rollinson, H. R., 1992, Interpreting Geochemical Data: Evaluation, Presentation and Interpretation.352 pp.
- Pinder, G. F., 2002, Groundwater Modeling Using Geographical Information Systems, *John Wiley & Sons*.
- Gustafsson, P., 1993, High resolution satellite data and GIS as a tool for assessment of groundwater potential of a semi-arid area, IXth Thematic conference on Geologic Remote Sensing, Pasadena, California.
- Freedman, P., 1949, The Principles of Scientific Research, *Mc Donald and Co*, London.
- Rajammal, P., Devadas and Kulandaivel., 1976, A Handbook of Methodology and Research, *Sri R. K. M. Vidyalyaya Press*, Coimbatore.
- Kumar, K. L., 2008, Educational Technology, New Age International Publishers.
- Sharma, R. A., 2006, Fundamentals of Educational Technology, Surya Publications, Meerut.

**COURSE II**  
**M16GY2 RECENT TRENDS IN GEOLOGY**

**UNIT I**

Geochemistry and its application to geological problems in Archean rocks- Distribution of Trace elements in different rock types and their significance in Petrological studies of Igneous, Sedimentary and Metamorphic rocks – Gneiss - Granulite terrain - Distribution in space and time – Geochronology and Isotope data - Different rock Formations and their geochemical aspects - Origin and evolution of Gneiss - Granulite terrain – Mineralization in the Archean High grade regions.

**UNIT II**

Quality of Ground Water – physical, Chemical and Biological constituents of Groundwater- Water quality criteria for drinking, industrial and irrigation purposes - Flow net analysis - Saturated and unsaturated flow net - Seepage flow and Dupuit flow - Hydrologic budgets – Hill - slope hydrology and stream flow generation - Groundwater in Crystalline and Sedimentary systems - Piezometric tests- Pumping tests - Basin yield - Sea water intrusion - Sources of groundwater contamination - Groundwater and Economic mineralization.

**UNIT III**

Fundamental concepts of Environmental Geology - Renewable energy sources - Geothermal resources - Solar energy - Atomic energy - Tidal energy - Water power - Wind power - Energy from Biomass - Energy and water demand - Energy for tomorrow.

**UNIT IV**

Air pollution and global climatic change - Mineral resources of the Ocean - Waste Disposal methods. Concentration of Trace elements in the Environment - Effects of Trace elements – Chromium – Cobalt - Flourine – Molybdenum - Influence of Geology and Geography on Disease - Water composition and cardiovascular health - Endemic goiter – Osteoporosis - Dental cavities - Cardiovascular mortality.

**UNIT V**

**Geologic Surveying, Field work, Mapping and Sampling Analysis:** Geologic surveying - Geological mapping and field work with igneous - sedimentary and metamorphic rocks; Use of topographic maps, air photographs and remote sensing images for geologic mapping - instruments (Compass, GPS) in geological mapping - Sub-surface geologic surveying - mine-surveying - study of data from drilled holes - well-logging.

## REFERENCES

- Brain Mason, C. B. and Moore, 2004, Principles of Geochemistry - 4<sup>th</sup> Edition, Wiley Eastern, New Delhi.
- Pichamuthu, C. S., 1974, Archean Geology, Oxford and IBH Pub. Co., New Delhi.
- Todd., D. K., 1982, Groundwater Hydrology-Willey Interscience, New York.
- Freeze, R. A. and Cherry, J. A., Groundwater, Prientice Hall INC., UK.
- Keller, E. A., 1988, Environmental Geology-CBS Publishers and Distributors, New Delhi.
- Cargo, D. N. and Mallony Addison, B. F., Man and his environment, Addison Wesley Pub. Co., London.
- Davis, G., 1980, Statistical and Data Analysis in Geology-2<sup>nd</sup> Edition, Wiley Interscience, New York.
- Isobel Clark, 1980, Practical Geostatistics - Elsevier Pub.Co., London and New York.
- Krumbein and Graybill, 1964., Statistical Methods in Geology - McGraw Hill & Co.

## **COURSE III**

### **M16GY3 INSTRUMENTATION TECHNIQUES AND DATA ANALYSIS IN GEOLOGY**

#### **UNIT I**

Nature of geological data - scales of measurement - concepts and types of models in geology - sample population - population distribution and population density function and their properties. Statistical methods: mean, median and mode - standard deviation - skewness and kurtosis and their interrelationship - scatter diagrams - frequency distribution - histogram - coefficient of correlation and regression. Distribution of sample variance and chi square distribution - probability - testing normal distribution - students 't' test, 'f' test - confidence interval, analysis - calculation of variance- covariance, simple linear models - cluster analysis. Use of standard software analysis and interpretation of geological data.

#### **UNIT II**

Application to petrological and geochemical problems - Modern techniques of chemical investigation of minerals and rocks using spectrophotometer, Flame photometer, Atomic Absorption Spectrometer, XRF, Inductively Coupled Plasma Spectrometer, XRD and EPMA - Precision - accuracy-detection limits and standards. Petrography. Nuclear devices and techniques - Isotope age dating. Stable Isotope - Cosmic ray induced radioactivity.

#### **UNIT III**

Methods of Sampling and Analytical Techniques: Collection of air, water, soil, sediment and rock samples - Preparation of samples for microscopic examination and chemical analysis. Sedimentological techniques - Size and shape determination of grains in Clastic rocks and their graphic representations - Heavy mineral analysis. Palaeontological and Micropaleontological techniques pertaining to microfossils (Foraminifera, Ostrocooda, Spores and Pollen) - Separation, mounting and analysis of microfossils.

#### **UNIT IV**

Geological, Geophysical, Geochemical and Geobotanical methods pertaining to mineral, petroleum, Coal and groundwater exploration - well logging methods. Groundwater Geochemistry: Contamination of groundwater and its Control, graphical presentation of water quality data. Ground water contamination - problems of arsenic - nitrate and fluoride. Water table fluctuations - causative factors. Saline water intrusion in coastal aquifers and its prevention - problems and managements of groundwater - chemical - ecological and anthropogenic causes.

#### **UNIT V**

Applications of Remote Sensing to oil and Mineral Exploration - Site selection for Engineering projects - Geoenvironmental studies - Landslides. Introduction to GIS and its applications - Map Components - Preparation of topographic, Geologic, Geomorphic, Landuse and Soil maps - bathymetric maps.

## REFERENCES

- Skoog, A., James Holler and Stanley R. Crouch, Principles of Instrumental Analysis.
- Davis, J. C., Statistics and data analysis in Geology.
- Raktoe B. L. and Hubert, J. J., Basic Applied Statistics.
- Klugh, H. E., Statistics - The essential for research.
- Mode, E. B., Elements of statistics.
- Beveridge, W. I. B., 1952 The Art of Scientific Investigation, 3rd Edition, Bodley Head Pub. Co, London.
- Winchell and Winchell, 1968 Optical Mineralogy (Vol. I&II), Wiley Eastern Pvt. Ltd., New Delhi.
- Naidu, P. R. J., Johanssen's Optical Mineralogy, Allied Publishers Pvt. Ltd., New Delhi.
- Groves A. W., 1951, Silicate Analysis, Allen and Unwin Ltd., UK,
- Easton, Chemical Analysis of silicate Rocks, Elsevier Publications.
- Sears, S. W., 1958, Optics, Asia Publishing House, New Delhi.
- Azaroff, L. and Buerger, M. J. Power Method in X-ray Crystallography.
- Shapiro, L. and Brannock., W. M., 1956, Geological Survey Bulletin of America, No. 165, 1063.
- Lueder, R. D., Aerial Photography Interpretation, McGraw Hill Book & Co., New York.
- Miller, V. C. and Miller, C. F., Photogeology, McGraw Hill Book & Co., New York.
- Todd, D. K., 1982, Groundwater Hydrology, 2<sup>nd</sup> Edition, Wiley Inter-science, New York.
- Jones, D. J., 1958, Introduction to Microfossils, Harper & Brothers, USA.
- Brasier, M. D., 1985, Introduction to Micropaleontology, Chapman and Hall, UK.
- Bignot, 1985, Elements of Micropaleontology, Chapman and Hall, UK.
- Kummel. B., and Raup. D., 1965, Handbook of Palaeontological Techniques, W. H. Freeman and Co.
- Aswathanarayana, U., 1985, Principles of Nuclear Geology, Oxford & IBH Pvt. Ltd., New Delhi.
- Mukhopadhyaya, P., Mathematical Statistics.

## **COURSE IV**

### **M16GY4 - HYDROGEOLOGY AND GROUNDWATER MANAGEMENT**

#### **UNIT I**

Origin of water - meteoric, juvenile, magmatic and seawaters, Hydrologic cycle: precipitation, runoff, infiltration and evapotranspiration, Hydrographs - Subsurface movement and vertical distribution of groundwater, Concepts of drainage basin and groundwater basin. Springs, Classification of aquifers hydrological properties of rocks - specific yield, specific retention, porosity - Hydraulic conductivity - transmissivity - storage coefficient - water table fluctuations - causative factors - concept of barometric and tidal efficiencies - water table contour maps - Classification of rocks with respect to their water bearing characteristics - Hydrostratigraphic units - Groundwater provinces of India - Hydrogeology of India - Zones of India - wet lands.

#### **UNIT II**

Types of wells - drilling methods - construction, design, development and maintenance of wells - specific capacity and its determination. Unconfined - confined, steady - unsteady and radial flow conditions - Theory of groundwater flow - Darcy's Law and its applications - determination of permeability in laboratory and in field. Pumps tests - methods - data analysis and interpretation for hydrogeologic boundaries - Evaluation of aquifer parameters using Thiem-Theis-Jacob and Walton methods. Groundwater modeling - numerical and electrical models

#### **UNIT III**

Groundwater quality - physical and chemical properties of water - quality criteria for different uses - graphical presentation of water quality data - Groundwater quality in different provinces of India - problems of arsenic and fluoride - Saline water intrusion in coastal and other aquifers and its prevention - Groundwater contamination.

#### **UNIT IV**

Hydrogeological - lithological classification with respect of hydrologic properties - Hydraulic continuity in relation to geologic structures - Location of springs. Hydrogeomorphic mapping of the terrain using different images of different satellite missions - lineament mapping - shallow groundwater potential zone mapping using satellite images - Geological - lithological and structural mapping, fracture trace analysis - Subsurface geophysical methods - well logging for delineation of aquifers and estimation of water quality.

#### **UNIT V**

Groundwater problems in arid regions and remediation. Groundwater problems related to foundation work - mining - canals and tunnels - Problems of over exploitation and groundwater mining - Groundwater development in urban areas and rain water harvesting - Artificial recharge methods - Groundwater legislation - Sustainability criteria and managing renewable and non-renewable groundwater resources. Groundwater balance and methods of estimation.



## **REFERENCES**

Tolman, C. F. 1937 Groundwater, McGraw Hill, New York and London.

Todd, D. K. 1995 Groundwater Hydrology, John Wiley and Sons.

Driscoll, F. G. 1988 Groundwater and Wells, UOP, Johnson Div. St. Paul. Min., USA.

Raghunath, H. M. 1990 Groundwater, Wiley Eastern Ltd.,

Nagabhushaniah, H. S. 2001 Groundwater in Hydrosphere (Groundwater hydrology), CBS Publ..

Karant, K. R. 1989 Hydrogeology, Tata McGraw Hill Publ..

Davies, S. N. and De Wiest, R. J. N. 1966 Hydrogeology, John Wiley and Sons, New York.