

# School of Studies in Geology & WRM

Pt. Ravishankar Shukla University, Raipur, C. G.

## Syllabus for

### M. Phil (Geology) Examination 2014-15

The duration of M. Phil. Course in Geology shall be of One Year. The course consists of Two Theory Papers, One Practical and the dissertation. The following shall be the Scheme of Examination.

#### Scheme of Examination

S. No.	Theory Paper	Title of Paper	Marks Allocation
1.	I	Research Methodology in Geology	100
2.	II	Advanced Research in Geology (Any one of the Following Courses) A. Hydrogeology B. Applied Sedimentology C. Igneous and Metamorphic Petrology D. Mineral Deposits E. Mineral Exploration	100
3.	III	Lab Course in Geology (Based on theory Papers as given and opted above)	100
		Practical Exam - 70 Viva-voce - 20 Practical Record - 10	
4.	IV	Seminar (Based on Theory)	50
5.	V	Dissertation	
		a. Seminar based on dissertation b. Script evaluation c. Viva-voce examination	50 75 25
			150
		<b><u>Grand Total</u></b>	<b><u>500</u></b>

## Paper I – RESEARCH METHODOLOGY IN GEOLOGY

M. M. - 100

### Unit – I

Research methodology – An overview. Scientific hypothesis, Model, Theory and Philosophy of Research methodology in context to Earth Sciences. Facts and Law Formulating Hypothesis. Selection and formulation of research problem. Meaning and need of Research design. Field methods in Geology: Scale, Topographic map, Bearing. Attitudes of the planar and linear features and their standard notations.

### Unit – II

Methods of data collection. Primary and Secondary data. Observations and tests.

Precision and accuracy in geological data generation.

Statistical techniques for processing and analysis of data: Probability, Normal distribution, Binomial and Poisson distribution. Sampling – simple random sampling. Systematic/ Grid sampling stratified and cluster sampling. Sampling estimates – Central tendency parameters – mean, median, mode, variance, standard deviation, skewness, kurtosis. Null Hypothesis. Central Tendency parameters. Student's t Test, chi square Test.

### Unit – III

Microscopic techniques. Staining techniques for distinguishing Calcite-Dolomite, K- Feldspar-Plagioclase-Cordierite. Techniques in photomicrography. Application of x-ray diffraction data in determination of composition of Olivine and cordierite. NORM calculation and interpretation of ACF, AKF diagrams.

### Unit – IV

Computer application in Geology. Data analysis, interpretation and drawing inferences. Word processing software. Application of statistical and graphical software – Microsoft Excel and Harvard Graphics. Report Writing: Selection of chapters, Methods of citing References.

## Paper II – ADVANCED RESEARCH IN GEOLOGY

### Course A – HYDROGEOLOGY

M. M. – 100

#### Section A.

1. Aquifers and their types. Determination of aquifer properties – porosity, permeability, transmissivity and strativity.
2. Laws of ground water flow. Its application and limitations.
3. Well hydraulics – steady, unsteady and radial flow to well. Boundary effect on unsteady well flow.
4. Leaky aquifer. Image wells and hydraulics of open wells.
5. Well Types and method of water well drilling.
6. Design and construction of Dug well and Tube wells.
7. Quality of ground water and its applications.

#### Section B.

8. Ground water exploration– geological and hydrogeological.
9. Geophysical methods of ground water exploration – resistivity survey and Seismic survey.
10. Application of remote sensing in ground water studies.
11. Ground water development and management, water balance studies.
12. Water logging and artificial recharge.
13. Groundwater pollution.
14. Occurrence and potentials of ground water in various geologic provinces of India.

### Course B - APPLIED SEDIMENTOLOGY

M.M. - 100

#### SECTION A.

1. Factors controlling the formation and deposition of different types of sediments.
2. Cyclic sedimentation, patterns and interpretation.
3. Classification, petrology and petrogenesis of limestone and dolomites.
4. Classification, petrology and paragenesis of detrital sedimentary rocks.
5. Application of grain shape-size analysis of sediments to environment interpretation.
8. Implications of diagenesis of carbonate and clastic sediments acting as reservoir rocks for oil and gas.

#### SECTION B.

9. Role of Sedimentological framework in understanding coal gasification and coal bed methane.
10. Mineral deposits associated with clastic sedimentary rocks.
11. Mineral deposits associated with non-clastic sedimentary rocks.
12. Plate tectonics-sedimentation and mineral deposits
13. Regional geology of Archaean rocks of India and related mineral deposits.
14. Regional geology of Precambrian rocks of India and related mineral deposits.

**Course C - IGNEOUS AND METAMORPHIC PETROLOGY      M.M. - 100**

Section A.

1. The composition and mineralogy of the mantle.
2. The structure, petrology and composition of the Earth crust.
3. Meteorites: classification, petrography, bulk chemical characteristics and origin.
4. Properties, origin and environments of magma generation.
5. Composition and kinetic of magma: viscosity, formation of crystals in liquids, Vesciculation, Causes of boiling and cooling, role of volatiles.
6. Geochemical affinity substitution of trace elements for major elements, partition coefficient.
7. Ophiolite complexes, calc alkaline and tholeiite groups, plutonic and volcanic rocks of subduction zone.

Section B.

8. Plate tectonics: Tectonics magmatism and regional metamorphic belts.
9. Metamorphic structure of continental crust and evolution of the earth.
10. Ocean floor metamorphism and its significance.
11. Kinetic of metamorphic minerals reaction. Concept of Rate theory. Direct experiments, stability field of minerals.
12. Basic principles of isotopes geology and it's application in petrology.
13. Experimental and theoretical study of metamorphic systems.
14. Chemical fractionation and distribution of elements during metamorphism zoning (Thomson Model)

**Course D - MINERAL DEPOSITS      M.M. - 100**

Section A.

1. Environment of mineral deposition.
2. Metallogenic processes.
3. Metallogenic opaque and province.
4. Ore texture, structure and mineral Paragenesis.
5. Geo-thermometry and isotopic studies of ore minerals.
6. Mineral deposit associate with plate margins.
7. Mineralogy, geochemistry and genesis of iron and manganese.

Section B.

8. Mineralogy, Geochemistry and genesis of bauxite.
9. Geochemistry and genesis of Pegmatite deposits.
10. Mineralogy, Geochemistry and genesis of Base metal deposits including Au and Ag.
11. Mineralogy, Geochemistry and genesis of Cr and Ni deposits.
12. Mode of Occurrence, distribution and origin of radioactive mineral deposits.
13. Mode of Occurrence, distribution, mineralogy and genesis of recent polymetallic nodules.
14. Distribution, origin of non-metallic mineral deposits: Phosphorites, Beryl, Magnetite, fluorite, Diamond, Asbestos, and Graphite.

## Section A.

1. Explorations programs – objective of exploration pattern of exploration programs. Economics of exploration programs. Use of mathematical modeling in exploration.
2. Surface and subsurface exploration method, collection and evaluation of existing data reorganization.
3. Exploratory drilling - methods, pattern and sequence, logging of drill hole data, planning of exploration drilling holes.
4. Sampling ore bodies and estimating reserves.
5. Basic characteristics and application of various geo physical surveys and exploration of mineral deposits.
6. Basic characteristic method and application of exploration geochemistry and geo botany to mineral deposits.
7. Application of remote sensing in minerals explorations.

## Section B.

8. Statistical analysis and computer application to mineral exploration.
9. Mineral economics and mineral processing as applied to planning, development and management of exploration and mining.
10. Mineral property evaluation. Objective of evaluation and condition of evaluation, method of evaluation.
11. Environmental effect of mineral resources, development, conservation and substitution,
12. Impact of mineral processing and mining activities on the environment, mining hazard, pollution of atmosphere, and pollution due to mineral based industries.
13. Planning and management of land use, industrial solid waste deposit and management, environment guidelines for mineral exploration.
14. Study of selected Indian case histories of exploration of iron, manganese, bauxite, copper, lead – zinc, gold, mica, coal and phosphate deposits.

**PRACTICAL EXAMINATION (M. Phil. GEOLOGY)****M.M. - 100****Paper I – RESEARCH METHODOLOGY IN GEOLOGY**

- A.
1. Interpretation of geological maps.
  2. Study of rocks in hand specimen and thin sections and interpretation of genesis of rocks.
  3. Location of metamorphic facies on a P-T diagram.
  4. Plotting of different rock groups on ACF, AKF & AFM diagram.
  7. Problems on:
    1. Determination of background threshold and anomaly.
    2. Anomaly delineation coefficient.
    3. Correlation coefficients.
  8. Heavy mineral studies.
  9. Study of sedimentary structure in hand specimens and their significance.

**Paper II – ADVANCED RESEARCH IN GEOLOGY**

## Group A – HYDROGEOLOGY

1. Evaluation of morphometric parameters from drainage maps.
2. Problems on formation characteristic evaluation – porosity, Sp. Yield, Sp. Retention.
3. Preparation and analysis of water table contour maps.
4. Numerical problems on formation constant evaluation – transmissivity and storability.
5. Interpretation of ground water occurrence from surface geophysical survey data-Receptivity method.
6. Preparation of watershed maps from the satellite imageries and delineation of ground water potential zones.
7. Interpretation of water quality from chemical analysis data.

## Group B – APPLIED SEDIMENTOLOGY

1. Graphic representation of textural data and its interpretation.
2. Study of texture and petrogenesis of sandstone.
3. Study of texture and petrogenesis of limestone.
4. Study of sedimentary structure in hand specimen and their significance.

5. Study and interpretation of mineral deposits associated with sedimentary rocks.

#### Group C – IGNEOUS AND METAMORPHIC PETROLOGY

1. Study of texture and structure and determination of mineral Paragenesis in igneous and metamorphic rocks.
2. Calculation of volumetric modal percentage of individual mineral present in the rocks.
3. Preparation of different type of diagrams and their interpretation from the given chemical data.
4. Representation of metamorphic rocks in the ACF, AFM, AKF, AFM etc. diagrams and their interpretation.
5. Study of the geographical distribution and significant criteria of important igneous and metamorphic rocks of India.
6. Megascopic and microscopic study of important igneous and metamorphic rocks of India.

#### Group D – MINERAL DEPOSITS

1. Study of ores (Megascopic and microscopic) and their geographic distribution.
2. Study of geological and economic significance of some of the metallic and non- metallic deposits of India.
  - A Gondwana coal field- Raniganj, Jharia.
  - B Kolar Gold Field
  - C Panna Diamond field
  - D Zawar Pb-zn Deposits
  - E Oil field/ Petroliferous basin of India
  - F Copper Deposits – Mosabani, Khetri, Malanjkhand.
3. Study of the mineral deposits associated with plate Tectonics.
4. Study of geologic, economic significance and geographic distribution of raw materials used in the following mineral based industries: (a) Iron & Steel (b) Cement (c) Aluminum (d) Fertilizers
5. Geology and geographic distribution of radioactive minerals and the location of the processing unit in India.
6. Calculation of grade assay and reserve of mineral deposits.

#### Group E – MINERAL EXPLORATION

1. Interpretation of subsurface geology from geological data.
2. Calculation of ore reserves from given geological map and data.
3. Calculation of grade and averaging of assay value and demarcation of ore bearing zones
4. Preparation and interpretation of geochemical anomaly and maps.
5. Resistivity survey and interpretation of resistivity data.
6. Preparation and interpretation of gravity and magnetic anomaly maps.
7. Preparation of geological maps from aerial photographs.
8. Preparation of geological maps and lineaments maps from satellite imagery.
9. Mineragraphic studies of ore samples including study of ore texture and structure and determination of mineral Paragenesis.
10. Study of mineral beneficiation flow sheets of common ores (Cu, Pb, Zn, Mn)

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**Course C – BIOSTRATIGRAPHY**

**M. M. - 80**

**SECTION A.**

1. Concept of Biostratigraphy and its application in the study of Earth Science.
2. Study of Stratigraphic section in surface outcrops.
3. Study of subsurface Stratigraphic sections.
4. Procedure of stratigraphic correlation. The international Stratigraphic guide. Establishment of named unites. Correlation of Stratigraphic horizon.
5. Study of basin mapping methods.
6. Regional and global stratigraphic cycles.
7. Sedimentation cycle and faunal changes.

**SECTION B.**

8. Concept of palaeoecology. Method of palaeoecological analysis.
9. Environmental significance of difference fossil groups.
10. Morphology and classification of trace fossils.
11. Morphology and classification of foraminifera.
12. Morphology, variation and classification of the ostracoda.
13. Biosratigraphic and palaeoecologic significance of mega fossils.
14. Biosratigraphic and palaeoecologic significance of microfossils.

**Course G – APPLIED GEOCHEMISTRY**

**M. M. 80**

**Section A.**

1. Cosmic abundance of elements, neuceliosynthesis and distribution of elements in crust and & mantle.
2. Chemical character of moon and its comparison with crust.
3. Type and composition of meteorites.

4. Laws of thermodynamics and their applications, fugacity and activity.
5. Element variations during crystal liquid fractionation and their migration during metasomatic and metamorphic processes.
6. Application of isotopes, distribution in magma genesis and ore deposits.
7. Application of geochemistry in genetic study of igneous rocks, amphibolites, pegmatite, and granite.

#### Section B.

1. Variation pattern in distribution of elements in igneous rocks with time, their application on crustal evolution.
2. Distribution of elements in sedimentary and metamorphic rocks of Archaean and their application on crustal evolution.
3. Sampling, Precision and accuracy in geochemical analysis.
4. Analytical instruments and their working principles (AAS, XRF, Emission Spectrographs).
5. Dispersion of elements, primary and secondary rock weathering.
6. Application of geochemistry in mineral exploration.
7. Statistical analysis of geochemical data for interpretation.