

M.D. University, Rohtak

M.Sc. (Previous) Geology

(W.e.f. session 2012-2013)

Scheme of Examination, Maximum Marks and Internal Assessment

Note: The examination of semester 1st and 2nd semester will consist of four theory papers, each of three hours duration and three practical examination, each of three hours duration.

The examination of dissertation (Geological) Field Report with Viva-Voce will be held in 2nd Semester.

1st Semester

Paper Code	Title of the Paper	Max. Marks	I.A.	Teaching Hrs./Week
Paper-101	Geomorphology	80	20	4 ½
Paper-102	Structural Geology	80	20	-do-
Paper-103	Crystallography	80	20	-do-
Paper-104	Igneous Petrology	80	20	-do-
Paper-105	Practical- Structural Geology	*	--	-do-
Paper-106	Practical- Crystallography	*	--	-do-
Paper-107	Practical- Petrology	*	--	-do-
Grand Total		400		

Note: * indicates that practicals to be conducted annually along with even semesters.

2nd Semester

Paper Code	Title of the Paper	Max. Marks	I.A.	Teaching Hrs./Week
Paper-201	Geomorphology & Remote Sensing	80	20	4 ½
Paper-202	Structural Geology & Tectonics	80	20	-do-
Paper-203	Mineralogy	80	20	-do-
Paper-204	Metamorphic Petrology & Geochemistry	80	20	-do-
Paper-205	Practical- Structural Geology	50	--	-do-
Paper-206	Practical- Mineralogy	50	--	-do-
Paper-207	Practical- Petrology	50	--	-do-
Paper-208	Dissertation	100	--	-do-
Paper-105	Practical- Structural Geology	50	--	-do-
Paper-106	Practical- Crystallography	50	--	-do-
Paper-107	Practical- Petrology	50	--	-do-
Grand Total		800		

Note:-

1. The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No. 1) of short answer type having eight sub-parts and covering all units.
2. The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. 1. All Questions carry equal marks.

M.Sc. (Prev.) - Geology
Ist- Semester
w.e.f. session 2011-2012
Paper-101- Geomorphology (Theory)

Max Marks: 100
Theory Marks: 80
I.A Marks : 20
Time: 3 Hrs.

Note:-

1. The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.
2. The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.

UNIT-I

Facts and figures regarding shape and size of the earth. Origin of the earth: A general review of all the theories.

Age of the Earth : Modern methods based on disintegration of Uranium, Thorium, Rubidium, Strontium, Potassium and Radiocarbon.

Interior of the Earth : Sources of knowledge, artificial sources, evidences from the theories of origin of earth, natural sources, seismology, density and temperature. Composition and structure of mantle and core.

UNIT-II

Isostasy : Definition, developments of idea through Pratt, Airy, Joly, Hayford and Bowie.

Plate Tectonics : Meaning and concept, Plate margin, Plate boundary, Sea floor spreading, Plate motion causes of plate motion. Plate tectonics and Continental drift, Plate tectonics and mountain building.

UNIT-III

Mountain Building : Orogeny, orogenic cycle, major orogenic periods of the earth. Theories of mountain building : Joly's theory of radioactivity and surface history of the earth; Jeffrey's contraction theory; Daly's theory of sliding continents; Kober's geosynclinal theory; Arthur Holme's convection current theory.

Landslide and Crustal displacement : Types of slides, causes and effects of slide, rock falls, rock slides, creep, earth flow and subsidence. Prevention of landslides.

UNIT-IV

Continental Drift : Permanence of land and basins. Continental drift : Taylor and Wegner's theories. Some recent views and evidences regarding continental drift.

Volcano : Volcanic phenomena, theories of volcanism, types of volcanoes, distribution of volcanoes in the world.

References

1. Thornburry, W.D., -- Principles of Geomorphology- John Wiley
2. Arthur Holmes, Nelson,--- Principles of physical Geology
3. Gupta, R.P., ---Remote Sensing Geology, Springer Veriag.
4. Pandey, S.N., ---Principles and Applications of Photogeology Wiley Eastern, New Delhi.
5. Sabbins, F.F.,---Remote Sensing- Principles and Applications , Freeman.

Paper-102- Structural Geology

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

1. **The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.**
2. **The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Stratification, Stratified rocks, conformable strata, exposure and outcrops of sedimentary rocks, horizontal beds, vertical beds, inclined beds, strike, dip, apparent dips, thickness of bed, trends of outcrops.

Mechanical Principles and Rock deformation : Earth forces, static and dynamic conditions, mechanical characteristics of the rocks, kinds of deformation, concept of stress and strain diagrams, Hook's law, factors controlling the behavior of material, confining pressure, temperature, time and solution, anisotropy and inhomogeneity, mechanics of plastic deformation.

UNIT-II

Folds : Description of folds, attitudes of beds in folds, parts of the fold, nomenclature of fold, symmetric, asymmetric, non-plunging and plunging folds, refolding, fold systems, doubly plunging folds, dome and basin, field study and representation of folds. Geometric and morphological classification of folds, relation of folding to pressure, genetic classification- flexure, flow and shear folding, mechanics of folding.

UNIT-III

Fracture and Joints : failure by rupture in the rocks, experienced data on tension, compression, couple and torsion, analysis of fracture, relation of rupture to stress and strain; nomenclature classification and signification of joints. **Top and Bottom criteria of beds** : Significance of various sedimentary structures like ripple marks, ridges and depressions, animal tracks, cross-beddings and current beddings, graded beddings, contemporaneous deformations; features of Igneous rocks, top of lava surfaces, pillow-lavas, volcanic ash, intrusive igneous bodies, drag folds and significance of palaeontology.

UNIT-IV

Extrusive Igneous Rocks : Lava flows, pyroclastic beds, fissure eruptions, character of central eruptions, volcanoes classification, craters, calderas and related forms, cryptovolcanic and related structures. Plutones-texture and internal structure, concordant bodies-sills, laccoliths, lapoliths, phacoliths etc.; discordant intrusive-dykes, volcanic vents, batholiths and stocks; granite tectonics.

Concepts of Petrofabric and symmetry : Objectives, field and laboratory interpretation on microscopic and mesoscopic scale, preparation of petrofabric diagrams, types of fabric, symmetry of fabric and symmetry of movements, their correlations : significance of π (pai) and β (beta) diagrams.

References

1. Badgley, P.C., 1965,--- Structure and tectonics. Harper and Row
2. Ramsay, J.G., 1967,--- Folding and Fracturing of Rocks, Mc Graw Hills
3. Ghosh, S.K., 1995,--- Structural Geology Fundamentals of modern developments, Pergamoh press
4. Turner, F.J. and Weiss, L.E.,---- Structural Analysis of Metamorphic Tectonics
5. Billings, M.P., ----Structural Geology

Paper-103- Crystallography

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

1. **The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.**
2. **The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Crystal elements, Crystal symmetry; the laws of crystallography, the common holohedral, hemihedral and hemimorphic forms in crystallography, zones, Stereographic projections, simple mathematical relationship.

UNIT-II

Twinning in crystals: The laws of twinning, composition plane and twin planes, twin axis, various examples of twins in crystals. The symmetry characters and forms of: Cubic- Normal Pyritohedral, Tetrahedral and plagiohedral.

UNIT-III

Tetragonal : Normal, tripyramidal class, pyramidal, hemimorphic, sphenoidal and trapezohedral.

Hexagonal : Normal, tripyramidal class, pyramidal, hemimorphic, trapezohedral, rhombohedral, rhombohedral hemimorphic, trirhomboidal.

UNIT-IV

Orthorhombic: Normal, hemimorphic, sphenoidal.

Monoclinic: Normal class **Triclinic :** Normal Class.

References

1. Dana, E.S. and Ford, W.E. : ----A text book of Mineralogy
2. Read, H.H., ----Rutley's elements of Mineralogy
3. Winchall, A.N. ,---- Elements of Optical Mineralogy
4. Phillips, W.M.R. and Griffen, D.T., 1986---- Optical Mineralogy

Paper-104- Igneous Petrology

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

1. **The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.**
2. **The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Introduction: Scope, importance and development of petrology. Classification of rocks.

Igneous Petrology: Magma , its composition, temperature, origin and evolution. Reaction principle and reaction series.

UNIT-II

Study of important single, binary and ternary silicate systems. Role of water in crystallization of basaltic magma. Magmatic differentiation and assimilation.

UNIT-III

Criteria for classification of Igneous rocks, Norms-CIPW and Niggli value, texture and structure of igneous rocks. Rocks suites and series, Petrographic provinces and periods. Kinds of Igneous rocks, Igneous rock association.

UNIT-IV

Petrogenesis of major igneous rocks such as Basalt, Granites, Alkaline rocks, Pegmatites and charnockite.

References

1. Philipotts, A., 1992 : ---Igneous and Metamorphic Petrology, Prentice Hall
2. Best, M.G., 1986 :----Igneous Petrology, CBS Publication.
3. McBirney, A.R, 1993 :---- Igneous Petrology, Jones and Barillet Publication.
4. Boss, M.K., 1987 : -----Igneous Petrology, World Press,

Paper-105- Practical- Structural Geology

Max Marks: 50

Time: 3 Hrs.

Map reading and drawing pertaining to conformable series, horizontal, vertical and inclined beds, pattern of dipping strata. Thickness and depth of strata. Determination of thickness of beds by various methods and order of superposition, three point problems.

Study and interpretation of geological maps and sections : simple, symmetrical, asymmetrical, overturned and isoclinal folds, domes and basins , unconformities, overlaps and offlap sections, faults.

Paper-106- Practical- Crystallography

Max Marks: 50

Time: 3 Hrs.

Study of important forms of cubic, tetragonal, hexagonal, orthorhombic, monoclinic and triclinic. Study of twinning in crystals of various systems. Stereographic projections of important forms of cubic tetragonal, and orthorhombic crystals.

Calculation of axial ratio and zone symbols in tetragonal, hexagonal and orthorhombic crystals.

Paper-107- Practical- Petrology

Max Marks: 50

Time: 3 Hrs.

Megascopic and microscopic study of Igneous rocks.

Megascopic and microscopic study of metamorphic rocks of different facies.

Interpretation of reaction textures.

M.Sc. (Prev.) - Geology
IInd- Semester
(w.e.f. session 2011-2012)
Paper-201- Geomorphology and Remote Sensing (Theory)

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

- 1. The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.**
- 2. The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Wind : Its geological action , erosional, transportational and depositional features, applied aspects such as engineering problems in loesses and sand dune areas. **Ocean** : Geological function of oceans , erosion and deposition as a continuous process along the shorelines. Shorelines of submergence and emergence. Waves, tides, currents, destructions of shorelines, littoral processes, Erosional and depositional features of ocean.

UNIT-II

Glacier : Types and movements of glaciers , erosion, transportation, deposition and resulting geomorphic surface features. Origin of glaciers, unstratified glacial deposits, stratified glacial deposits.

Ground Water : Sources of ground water, types of ground water, water table and the pressure surface and its related zones, erosion transportation and deposition and their resulting features. Springs, wells, artesian wells, geysers and fumaroles. **Hydrological cycle** : Rain fall and run of features of rain fall, erosion, evaporation, transportation and evapotranspiration processes.

UNIT-III

River : Erosion, Transportation and deposition and the related geomorphology, growth and development of river system, drainage and drainage pattern, erosion cycle, river terraces, flood plain and deltas, meandering , rejuvenation and piracy in rivers. **Lakes** : Description, bogs, swamps, origin of lakes, engineering problems. Lakes of India. **Coral reefs** : Definition and types of coral reefs, characteristics, optimum requirements for their development. Theories regarding the origin of coral reefs.

UNIT-IV

Applied Geomorphology : Meaning and concept, applied geomorphology in Indian context, geomorphology and regional planning, geomorphology and hazard management, geomorphology and urbanization, geomorphology and engineering works, geomorphology and hydrology, geomorphology and mineral exploration. **Remote Sensing** : Principles of remote sensing, general idea about aerial

photographs and their geometry. Application of Remote Sensing in Geology. Geological Studies; Image characters and their relation with ground object based on tone , texture and pattern. Principles of terrain analysis, evaluation of ground water potential, rock types, identification and interpretation of geographic and tectonic features.

References

1. Thornburry, W.D., Principles of Geomorphology- John Wiley
2. Arthur Holmes, Nelson, Principles of physical Geology
3. Gupta, R.P., Remote Sensing Geology, Springer Veriag.
4. Pandey, S.N., Principles and Applications of Photogeology Wiley Eastern, New Delhi.
5. Sabbins, F.F., Remote Sensing- Principles and Applications , Freeman.

Paper-202- Structural Geology and Tectonics

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

1. The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.
2. The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.

UNIT-I

Faults: General descriptive terminology, classification of faults geometric and genetic; field study, recognition of faults, discontinuity of structures, repetition and omission strata, characteristic features along fault planes, silicification and mineralization, differences in the sedimentary faces, physiographic criteria , distinction between fault line and scarp etc.

Relation of rupture to stress and strain, stress and faulting, fault pattern formed due to different orientation of principal stress axis , stress and strain ellipsoid.

UNIT-II

Unconformity : Kind s of unconformities, recognition of unconformities in outcrops, relation to plutonic rocks, palaeontological criteria, distinguishing faults and unconformities in the field.

Geophysical method in Structural Geology : General outline of various physical characters of rocks, general principles of methods used in the interpretation of structures based on gravitational, magnetic, seismic and electrical methods.

UNIT-III

Cleavage and Schistosity : Descriptive terminology, origin of slaty cleavage and schistosity, fracture cleavage, slip cleavage and schistosity to major structures. **Lineation :** Kinds of lineation, origin of

deformed pebbles and oolites, elongated minerals, intersection of bedding and cleavage, crinckles, slickensides and miner streakes, boudinage, rods and mullion structure, relation to the major structures.

UNIT-IV

Plate Tectonics : Concepts of plate margin, plate boundary, causes of plate motion. Recent advances, dynamic evolution of continental and oceanic crust, ridges, trenches and transform faults, formation of mountain roots, plate- tectonics and mountain belts, structure and origin of Alpine-Himalayan belt, the Applachian-Calidonian belt, the Andes, the North American cordillera.

References

1. Badgley, P.C., 1965, Structure and tectonics. Harper and Row
2. Ramsay, J.G., 1967, Folding and Fracturing of Rocks, Mc Graw Hills
3. Ghosh, S.K., 1995, Structural Geology Fundamentals of modern developments, Pergamoh press
4. Turner, F.J. and Weiss, L.E., Structural Analysis of Metamorphic Tectonics
5. Billings, M.P., Structural Geology

Paper-203- Mineralogy

Theory Marks: 80
I.A Marks : 20
Time: 3 Hrs.

Note:-

1. **The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight sub-parts and covering all units.**
2. **The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Physical properties of Mineral : Gliding planes, properties depending upon light, hardness, specific gravity, cleavage, fractures; isomorphism, polymorphism and pseudomorphism in minerals. Structure of silicates and its bearing on classification of various rock forming silicates. **Descriptive Mineralogy :** Detail study of rock forming mineral groups such as pyroxene, garnet and olivine, their physical, chemical and optical characters, occurrence, origin, association and alteration.

UNIT-II

Detail study of rock forming mineral groups such as amphibole, mica, feldspar, scapolite, feldspathoid and silica group, their physical, chemical and optical characters, occurrence, origin, association and alteration.

UNIT-III

Mineralogy of metallic ores : Iron Manganese, copper, lead and zinc, aluminium, tin, gold, silver, chromium, antimony, arsenic, titanium, uranium, molybdenum and mercury

UNIT-IV

Optical Mineralogy : The general principles of optics, the theories of the propagation of light, the optical properties of minerals. The preparation of materials for microscopic studies, study of birefringence, refractometer, double refraction, classification of crystals into isotropic and anisotropic crystals, the Nicol prism and Polaroid plate, polarization of light, interference colours in crystal and determination of their orders, birefringence in biaxial and uniaxial crystal and its determination, pleochroism and dichroism in crystals and their determination. Construction and use of accessories such as quartz wedge, gypsum plate and mica plate, the optical indicatrix of uniaxial and biaxial crystals, the determination of optic sign, dispersion in crystals, extinction and its type, extinction angle and its determination, the optic axial angle and its determination.

References

1. Dana, E.S. and Ford, W.E. : A text book of Mineralogy
2. Read, H.H., Rutley's elements of Mineralogy
3. Winchell, A.N. , Elements of Optical Mineralogy
4. Dear, W.A., Howie, R.A. and Zussman, J, 1996: The Rock Forming Minerals, Longman.
5. Paul, F. Kerr, Optical Mineralogy

Paper-204- Metamorphic Petrology and Geochemistry

Theory Marks: 80

I.A Marks : 20

Time: 3 Hrs.

Note:-

1. **The examiner will set nine questions in all, selecting two questions from each unit and one question (Q. No.-1) of short answer type having eight parts and covering all units.**
2. **The candidate will attempt five questions in all, selecting one question from each unit and the compulsory Q. No. - 1. All Questions carry equal marks.**

UNIT-I

Process and kinds of metamorphism. Facies and grades of metamorphism. Texture and structures of metamorphic rocks. Metamorphic minerals and idioblastic series.

UNIT-II

Application of phase rule to metamorphic petrology. Concept of facies – facies of contact metamorphism. Metasomatism and retrograde metamorphism.

UNIT-III

Study of the facies of the regional metamorphism. Metamorphic differentiation. Anatexis and palingenesis. Oceanic floor metamorphism. Nature of metamorphic reactions and pressure- temperature conditions of metamorphism.

UNIT-IV

Geochemical and trace elements, their abundance and classification, Geochemical prospecting. Sedimentation, classification and characters of sedimentary rocks. Origin of migmatites, khondalite and eclogite.

References

1. Turner, F.J., 1980: Metamorphic Petrology, McGraw Hills, New York
2. Yardley, B.W., 1989 : An Introduction to Metamorphic Petrology, Longman, New York
3. Bucher K. and Frey, M. 1994 : Petrogenesis of Metamorphic Rocks, Springer, Verlag
4. Philipotts, A., 1992 : Igneous and Metamorphic Petrology, Prentice Hall
5. Kretz, R., 1994 : Metamorphic Crystallization, John Wiley

Paper-205- Practical- Structural Geology

Max Marks: 50

Time: 3 Hrs.

Recording and plotting of field data. Preparation and interpretation of structural contour maps. isopach, isochore, isolith and isograde maps. Orthographic projections and geometric solutions for fault and three point problems.

Stereographic solution of true and apparent dip, plunge and rake of intersection of two planes and fold axis of plunging fold, fault problems. Study of large scale tectonic features of the earth.

Paper-206- Practical- Mineralogy

Max Marks: 50

Time: 3 Hrs.

A study of megascopic and microscopic characters of important rock forming mineral. Determination of refrengence by immersion method using Becke Effect, interference colours, pleochroic scheme of biaxial minerals. Study of conosopic figures of uniaxial and biaxial crystals using optic axial and acute bisectrix figures.

Determination of extinction angle using sensitive tint plat.

Determination of optic axial angle on the universal stage.

Paper-207- Practical- Petrology

Max Marks: 50

Time: 3 Hrs.

Study of structures of metamorphic rocks in hand specimen and in thin section.

Study of typical rock assemblages in hand specimen and in thin section and their petrogenetic interpretation.

Interpretation of chemical analysis of rocks.

Paper-208- Dissertation

Max Marks: 100

1. Each student shall be required to go for a field work to a suitable area for surface geological mapping for maximum one week under the supervision of the teachers of the department.
2. The dissertation will be submitted normally and the end of second semester and will be examined along with the practical papers.