

M.D. University, Rohtak

M.Sc (Previous) Geology
(w.e.f. session 2011-2012)

Scheme of Examination, Maximum Marks and Internal Assessment

Note: The examination of semester I and semester II 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 semester II.

Ist Semester

		Max. Marks	I.A	Teaching Hrs./ Week
Paper- 101	Geomorphology	80	20	4 and half
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	50	-	-do-
Paper- 106	Practical- Crystallography	50	-	-do-
Paper- 107	Practical- Petrology	50	-	-do-
	Grand Total	550		36

IInd Semester

		Max. Marks	I.A	Teaching Hrs./ Week
Paper- 201	Geomorphology & Remote Sensing	80	20	4 and half
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	-	-
	Grand Total	650		36

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

L.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 Barlet 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, crinkles, 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 Appalachian-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.

M.D. University, Rohtak

M.Sc (Final) Geology (w.e.f. session 2012-2013)

Scheme of Examination, Maximum Marks and Internal Assessment

Note1: The examination of semester III and semester IV will consist of four theory papers, each of three hours duration and two practicals, each of three hours duration.

The examination of dissertation (Geological Field Report) with Viva-Voce i.e. geological surface/sub-surface mapping will be in semester IV.

Note2: The candidate will have to study the following three compulsory papers and one optional paper.

IIIrd Semester

Paper Code	Title of Paper	Max. Marks	I.A	Teaching Hrs./ Week
Paper- 301	Stratigraphy	80	20	4 and half
Paper- 302	Ore-genesis & Indian Mineral Deposits -I	80	20	-do-
Paper- 303	Engineering Geology	80	20	-do-
Paper- 304	One of the following papers. Option (i) Sedimentology Option (ii) Advance Tectonics and Himalayan Geology -I Option (iii) Environmental Geology -I	80	20	-do-
Paper- 305	Practical- Economic Geology	50	-	-do-
Paper- 306	Practical- Engineering Geology	50	-	-do-
	Grand Total	500		36

IVth Semester

Paper Code	Title of Paper	Max. Marks	I.A	Teaching Hrs./ Week
Paper- 401	Palaeontology	80	20	4 and half
Paper- 402	Ore-genesis & Indian Mineral Deposits -II	80	20	-do-
Paper- 403	Hydrogeology	80	20	-do-
Paper- 404	One of the following papers. Option (i) Petroleum Geology Option (ii) Advance Tectonics and Himalayan Geology -II Option (iii) Environmental Geology -II	80	20	-do-
Paper- 405	Practical- Economic Geology	50	-	-do-
Paper- 406	Practical- Engineering Geology & Hydrogeology	50	-	-do-
Paper- 407	Dissertation	100	-	-
	Grand Total	600		36

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.

IIIrd- Semester
w.e.f. session 2012-2013
Paper-301- Stratigraphy

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

Stratigraphic principles and practice : Basic principles and definition, stratigraphic classification and nomenclature. Stratification and stratigraphic columns. Lateral variations and facies. Stratigraphic correlation. Orogenic succession. **Indian Stratigraphy :** Review of chief structural and stratigraphical features of Indian subcontinent. Structural and tectonic history of Indian subcontinent (Aravalli, Easternghats, Satpura and Mahanadi strike trends and their relative edges. Structure of Himalayas.

Archean groups : Distribution in peninsular and extrapeninsular regions. Classification and correlation of Dharwars.

UNIT-II

Cuddapah and Vindhyan System : Distribution and geological succession in peninsular India. Age and correlation of vindhyans. **Palaeozoic group :** Distribution, geological succession and fauna of each. Age of saline series.

UNIT-III

Gondwana Group : Distribution, geological succession and classification, fauna and flora. Age limits and structure of Gondwana basin. Palaeogeography. **Mesozoic Group :** Distribution, geological succession and classification, fauna and flora of Triassic of Spiti, Jurassic of Kutch and Cretaceous of Trichinopoly.

UNIT-IV

Deccan Traps : Distribution, geological succession, Petrology and alteration of traps. Lameta beds. Inter-Trappeans and infra-trappeans beds. **Tertiary Group :** Break up of Gondwana land. Himalayan orogeny. Distribution succession and fauna of each of the systems. **Siwalke System :** Distribution, succession, conditions of sedimentation, fauna and correlation.

References

1. Wadia, D.N., Geology of India,McMillan

2. Goodwin, A.M., 1991 : Precambrian Geology : The Dynamic Evolution of Continental Crust. Academic Press
3. Boggs, Sam Jr., 1995: Principles of Sedimentology and Stratigraphy, Prentice Hall
4. Brenner, R.E. and MeHargue, T.R., 1998 : Integrative Stratigraphy : Concepts and Applications, Prentice Hall
5. Krishnan, M.S., : Geology of India

Paper-302- Ore-Genesis & Indian Mineral Deposits -- I

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

Ore deposits and ore minerals : Classification of ore deposits, magma and its relation to mineral deposits, orthomagmatic deposits, pegmatic deposits, pyromagmatic deposits, hypothermal, mesothermal and epithermal deposits. Processes of formation of mineral deposits: Magmatic concentration-early and late magmatic deposits.

UNIT-II

General forms, structures and textures of mineral deposits, control of mineralization; Structural and stratigraphic. Geological thermometers, metallogenetic epochs and provinces. **Secondary Enrichment :** Oxidation, solution and precipitation in the zone of oxidation and supergene sulphide enrichment.

UNIT-III

Deposits formed by the processes of Mechanical Concentration. Weathering products and residual deposits. Metasomatism and metamorphic deposits. **Hydrothermal deposits :** cavity filling and replacement deposits.

UNIT-IV

Mode of occurrence of ore bodies- morphology and relationship of host rocks. Textures, paragenesis and zoning of ores. **Fluid inclusions in ores :** Principles, assumptions, limitations and applications. Mode of occurrence, association and distribution of atomic minerals in India. Atomic minerals as a source of energy.

References

1. Craig, J.M. and Vaughan, D.J., 1981 : Ore Petrography and Mineralogy. John Wiley.
2. Evans, A.M.,1983 : Ore Geology and Industrial Minerals, Blackwell
3. Guilbert, J.M., and Park, Jr. C.F.,1986 :The Geology of Ore Deposits. Freeman.
4. Bateman, A.M., : Principles of Economic Mineral Deposits.

Paper-303- Engineering 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

Engineering Geology : Introduction, application of geology to engineering and co-ordination between the two discipline. Engineering properties of rocks. Effect of geological structures. Rocks in foundation materials. Rock effects, treatments and grouting. Clay minerals and their properties. Engineering behaviour of clays and soils.

UNIT-II

Landslides: Definition, classification, causes and stability of hill slopes. **Soil :** Formation of soils, soil profile, soil types of India, soil organization and conservation. Elements of soil mechanics.

UNIT-III

Dams and Reservoirs : Introduction, classification according to use, classification according to hydraulic design and classification according to material. Types of dams, criteria for the selection of a dam site. Forces acting on a dam.

UNIT-IV

Tunnels : Their types, alignment of tunnel in relation to geological air fields. Problems of their construction in mountaineous regions. Bridge abutments. Geology of aggregates, pozzolanic materials; rocks, gravels, sand, clays and construction materials. Elements of sub-surface geological investigations.

References

1. Krynine, D.H., and Judd, W.R., 1998 : Principles of Engineering Geology, C.B.S. Edition

2. Bell, F.G., : Engineering Geology- Butterworth Heinemann
3. Punmia, B.C. : Introductory Engineering Geology, Anand Publisher and Distributor, Delhi

Paper-304
Option (i)- Sedimentology

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

Earth Surface System : The study of sediments, liberation and flux of sediments; Processes of transportation and generation of sedimentary structures. **Sedimentary Environment :** Continental, alluvial, fluvial, lacustrine, desert, Aeolian and glacial environment. Shallow coastal, clastic, marine and continental evaporites and shallow water carbonates.

UNIT-II

Palaeocurrent basin analysis : Cross-bedding and linear structure and palaeocurrent studies.
Evolution of Sedimentary Basins : Tectonics and Sedimentation, sedimentary domains and their classification, geosynclinal cycle. **Facies Concepts:** Sedimentary facies, the operational concept of facies.

UNIT-III

Sedimentary Rocks : Classification and petrography of various sedimentary rocks.
Lithification and diagenesis : Cementation and decementation, Authigenesis, diagenetic differentiation, diagenetic metasomatism, intrastratal solutions, compaction.

UNIT-IV

Sedimentary Texture : Texture of clastic rocks- shape, roundness, surface texture, fabric and packing, porosity and permeability. Texture of non-clastic (chemical) sediments. **Sedimentary structures :** Introduction and classification, mechanical (Primary) structures and chemical (Secondary) organic structures. Principles and methods of grain size and shape analysis. Techniques of heavy mineral separation, heavy mineral suits and provinces.

References

1. Petti John, F.J., Sedimentary Rocks
2. Corrozzi, A.V., Microscopic Sedimentary Petrography
3. Krumbein, W.C., Sloss, L.L., : Stratigraphy and Sedimentation

Paper-304
Option (ii)- Advanced Tectonics and Himalayan Geology -- I

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

Earth movements and their influence on sedimentation. Study of rocks deformation, continuous and discontinuous. Rock displacement

UNIT-II

Deformation of non-tectonic origin. Kinematic interpretation of tectonic deformation. Tectonics of flow. Dynamic and mechanical interpretations.

UNIT-III

Mechanism of over thrusts and nappe structures. Gravitational tectonics. Rift and Wrench fault systems.

UNIT-IV

Orogeny, characteristics of various orogenies. Alpine and Hmalayan orogenies and tectonic approach to continental drift. Reviw of various theories of mountain building. Growth of continents.

References

1. Ganysser: Himalayan Geology

Paper-304
Option (iii)- Environmental Geology -- I

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

Time scale of global changes in the ecosystem and climate. Impact of circulations in atmosphere and oceans on climate, rainfall and agriculture.

UNIT-II

Carbon di-oxide in atmosphere, limestone deposits in the geological sequence, records of palaeotemperature in ice cores of glaciers. Global warming caused by CO₂, increase in present atmosphere due to indiscrete exploitation of fossil fuels, volcanic eruptions and afforestation.

UNIT-III

Cenozoic climate extremes, evolution of life, especially the impact on human evolution. Impact assessment of degradation and contamination of surface water and ground water due to industrialization and urbanization.

UNIT-IV

Water logging problems due to the indiscrete construction of canals, reservoirs and dams. Soil profiles and soil quality, degradation due to irrigation, use of fertilizers and pesticides.

References

1. Valdiya, K.S., 1987 : Environmental Geology – Indian Context. Tata McGraw Hill
2. Keller, E.A., 1987 : Environmental Geology, Bell and Howell, USA
3. Bell, F.G., 1999 : Geological Hazards, Routledge, London
4. Smith, K., 1992 : Environmental Hazards, Routledge, London

Paper-305- Practical- Economic Geology

Max Marks: 50

Time: 3 Hrs.

Megascopic study of structures and fabric of different ores and their association.

Mineralogical and textural studies of important ore minerals under ore microscope.

Study of other industrial and non-metallic minerals in hand specimen of (i) Refractories (ii) Glass and Ceramic (iii) Abrasives.

Preparation of polished ore specimen.

Paper-306- Practical- Engineering Geology and Hydrogeology

Max Marks: 50

Time: 3 Hrs.

Study of properties of common rocks with reference to their utility in engineering projects.

Study and interpretation of geological maps involving dam sites, tunnels, roads and stability of hillslopes.

Interpretation of bore hole data.

**M.Sc. (Final) - Geology
IVth- Semester
w.e.f. session 2012-2013**

Paper-401- Palaeontology

Theory Marks: 80

LA 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

Fossils, their nature, conditions of fossilization, mode of preservation and uses. Detailed morphology, classification and geological history of Brachiopods, Lamellibranchs and Gastropods.

UNIT-II

Morphology, Classification and geological history of Echinoderms and Foraminifera. Evolutionary history of Man, Horse and Elephant.

UNIT-III

Morphology, Classification and geological history and evolution of Trilobites, Graptolites and Ammonites. Principal groups of vertebrates with emphasis on Gondwana and Siwalik fauna.

UNIT-IV

Plant Fossils : Flora of lower and upper Gondwana, its significans and distribution.

Micropalaeontology: Its importance with special reference to Foraminifera, their ecology and palaeoecology.

References

1. Moore, Lalicker and Fischer : Invertebrate Fossils.
2. Woods, H.,: Palaeontology
3. Shrock : Invertebrate Palaeontology

Paper-402- Ore-genesis & Indian Mineral Deposits -- II

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-arts 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

Mineralogy, genesis, uses and Indian distribution of ore minerals related to Iron, Maganese, Chromium, Copper, Lead and Zinc, Aluminium and Gold.

UNIT-II

Study of origin, mode of occurrence, use and Indian distribution of – Mica, Asbestos, Baryte, Gypsum, Apatite, Beryl, Garnet, Kyanite, Sillimanite, Andalusite and Talc.

UNIT-III

Study of mineralogy, Indian distribution of important non metals related to refractory, fertilizer, cement, Abrasive and gem stone industry.

UNIT-IV

Definition and origin of coal, fundamentals of coal petrology: Peat, lignite, Bituminous and Anthrasite coal. Geological and Geographical distribution of coal deposits in India. **Petroleum** : Composition, origin and migration of oil and gas, oil bearing basins of India. Geology of productive oil field of india.

References

1. Bateman, A.M. : Principles of Economic Mineral Deposits
2. Lindgreen, W.L.: Mineral Deposits
3. Coggin, Brown and Dey A.K. : India's Mineral Wealth

Paper-403- Hydrology

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

Hydrology: Introduction, definition, origin and vertical distribution of ground water. Hydrological cycle, precipitation, evapotranspiration, infiltration and surface run off. Geological formations as aquifers. Types of Aquifers, springs and Geysers. Ground water flow, darcy's law and its range of validity, steady and unsteady flow.

UNIT-II

Hydrological properties of water bearing materials : Porosity, permeability, transmissibility and storage coefficient. Principles of ground water occurrence: Occurrence of ground water in Igneous, Sedimentary and Metamorphic rocks. Confined and unconfined ground water.

UNIT-III

Ground water development: Surface investigation of ground water, prospecting for ground water, construction design and development of water wells. Hydraulics of well : water table and artesian well. Pump test analysis and determination of aquifer characteristics. Theory of image well. Leaky aquifer and partially penetrating wells. Relation of yield to draw down and diameter. Ground water level fluctuation: Secular and seasonal variations, stream flow and ground water levels, fluctuation due to evapotranspiration, fluctuation due to meteorological phenomena, fluctuation due to tides, external bodies and earth quakes.

UNIT-IV

Artificial recharge of ground water : Methods of artificial recharge. Fresh and salt water relationship in coastal areas. Ground water provinces of India. **Quality of Ground Water :** Sources of salinity, ground water samples, measures of water quality, chemical analysis, physical analysis and bacterial analysis, water quality criteria. Base Exchange. Determination of ground water quality.

References

1. Todd, D.K., 1980 : Ground Water Hydrology, John Wiley
2. Devies, S.N. and De West , R.J.M., 1966 : Hydrology, John Wiley
3. Raghunath, N.M., 1982: Ground Water , Wiley Eastern
4. Karanth, K.R., 1987 : Ground Water Assessment. Development and management. Tata McGraw hill

Paper-404 **Option (i)- Petroleum 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

Introduction, composition and occurrence of petroleum , mode of occurrence- surface and sub-surface occurrences, oil pools, fields and provinces. **Origin of Petroleum** : Inorganic and organic origin, transformation of organic matter into Kerogene, thermal cracking of Kerogene. **Migration and Accumulation of Petroleum** : Short or long migration, primary migration and secondary migration.

UNIT-II

Characteristics of Reservoir rocks : Reservoir rocks, classification, nomenclature, fragmental, chemical and miscellaneous, marine and non-marine reservoir rocks, reservoir pore spaces- porosity of permeability. **Reservoir Traps** : Introduction, General, Structural, Stratigraphic and combination traps.

UNIT-III

Reservoir fluids : water, oil and gas. **Surface Geological Methods** : Prospecting for oil and gas, drilling methods, drilling fluids, sub-surface sampling and examination of well-cuttings, interpretation and correlation of well logs, methods of estimation of oil and natural gas reserves.

UNIT-IV

Petroleum Provinces : oil and gas fields of the world. Sedimentary basin and oil fields of India, oil prospects in India, position of oil and natural gas in India, future prospects and economic scenario.

References

1. Hoison, G.D. and Tiratsoo, E.N. 1985 : Introduction to Petroleum Geology, Gulf Publ. Houston, Texas.
2. Tissot, B.P. and Welte, D.H., 1984 : Petroleum Formation and Occurrence. Springer Verlag
3. Selley, R.C., 1988 : Elements of Petroleum Geology, Academic Press
4. Levorsan, A.I.: Petroleum Geology

Paper-404

Option (ii)- Advance Tectonics and Himalayan Geology -- II

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

Island arcs and oceanic trenches. Geological cycle. Drainage patterns and its relation to the tectonics.

UNIT-II

Structural and tectonic units of earth's crust. Detailed study of the structural and tectonic history of India.

UNIT-III

The wider frame of Himalaya. Geological history of Himalaya. Regional history of Himalaya. Regional structural pattern of Himalaya.

UNIT-IV

Study of various tectonics elements of Himalaya. Geology and structure of the Himalayan belts of Kashmir, Himachal, Garhwal, Kumaon, Nepal, Sikkim-Bhutan and NEFA.

References

1. Ganysser: Himalayan Geology

Paper-404

Option (iii)- Environmental 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

Influence of neotectonics in seismic hazard assessment. Preparation of Seismic hazard maps. Distribution magnitude and intensity of earthquakes.

UNIT-II

Study of seismic and flood-prone areas in India. Analysis for alkalinity, acidity, P^H and conductivity (electrical) in water samples.

UNIT-III

Classification of ground water for use in drinking irrigation and industrial purposes. Presentation of chemical analysis data and plotting chemical classification diagram.

UNIT-IV

Evaluation of environmental impact of air pollution, ground water, landslides, deforestation, cultivation and building construction in specified areas.

References

1. Valdiya, K.S., 1987 : Environmental Geology – Indian Context. Tata McGraw Hill
2. Keller, E.A., 1987 : Environmental Geology, Bell and Howell, USA
3. Bell, F.G., 1999 : Geological Hazards, Routledge, London
4. Smith, K., 1992 : Environmental Hazards, Routledge, London

Paper-405- Practical- Economic Geology

Max Marks: 50

Time: 3 Hrs.

Mineralogical and textural studies of important ore minerals under ore microscope.

Study of Industrial and non-metallic minerals in hand specimen of (i) Fertilizer (ii) Building Material (iii) Gemstones (iv) Cement Industry.

Study of important metallic ore minerals in hand specimen with special reference to their physical character, association, structure and probable origin.

Preparation of mineral maps of India.

Diagrammatic representation of open-cast and underground mining.

Paper-406- Practical- Engineering Geology and Hydrogeology

Max Marks: 50

Time: 3 Hrs.

Study of properties of common rocks with special reference to their utility in engineering projects.

Study and interpretation of hydrogeological maps involving ground water conditions and nature of streams.

Delineation of hydrological boundaries on water table contour maps.

Pumping test : time , draw- down and time-recovery test and evaluation of aquifer parameters.

7Paper-407- Dissertation

Max Marks: 100

1. Each student shall be required to go for a field work to a suitable area for geological mapping i.e. surface / sub-surface for one week under the supervision of teachers of the department.
2. The Dissertation will be submitted normally at the end of fourth semester and will be examined along with the practical papers.