

**M.D.UNIVERSITY, ROHTAK**  
**M.Sc (Previous) Geology - 2010-11**

Note : the examination will consist of four theory papers, each of three hours duration, and three practical examination each of three hours duration and the examination of Dissertation (Geological) field report with Viva-voce.

Note : The candidate will have to study the following compulsory papers.

IST SEMESTER	Max. Marks	Teaching Hrs.	
		IA	Per 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 - Structural Geology Practical	50		-do-
Paper 106 - Crystallography Practical	50		-do-
Paper 107 - Petrology Practical	50		-do-
Paper 108 - Dissertation	----		-do-
Total	550		36

IIND SEMESTER	Max. Marks	Teaching Hrs.	
		IA	Per 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 - Structural Geology Practical	50		-do-
Paper 206 - Mineralogy Practical	50		-do-
Paper 207 - Petrology Practical	50		-do-
Paper 208 - Dissertation	100		-do-
Total	650		36

**Note : Dissertation (Field Work) :-**

- (i) Each student shall be required to go for a field work to a suitable area for geological mapping for maximum two weeks in type geological, area under the supervision of the teachers of the department.
- (ii) The Dissertation will be submitted normally at the end of second semester and will be examined along with the practical papers.

The procedure of award of Internal Assessment will be as under:-

I - The marks of internal assessment may be split as under:

- (A) One class tests of 10 marks. The class test will normally be held in the months of September for Ist Semester and in the months of April for IInd Semester.
- (B) Assignment/term paper & Presentation 5 marks
- (C) Attendance 5 marks
- |               |         |
|---------------|---------|
| Less then 65% | 0 marks |
| 65% to 75%    | 2 marks |
| 76% to 85%    | 3 marks |
| 86% to 90%    | 4 marks |
| Above 90%     | 5 marks |
1. The record of internal assessment be kept by the HOD/Principal concerned for three months only.
  2. Each Department/College concerned may form a committee to deal with complaints, if any, in this regard.
  3. The test of internal assessment shall be conducted by the Department/College concerned at their own level without any financial liability on the University and the student shall use 8 pages answer sheets which will be provided by the office of Dean Academic Affairs for University Teaching Departments & P.G. Regional Centre Rewari only. The words M.D.University, Rohtak (for internal test) be fabricated on the answer sheet by the University Press for Departments and PGRC, Rewari. Colleges shall arrange such answer sheets of 8 pages at their own level.

**M.Sc (P) GEOLOGY**  
**(Ist Semester) Paper - 101**  
**Geomorphology**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT - I**

Facts and figures regarding the 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, development of idea through Pratt, Airy, Arthur Holmes, 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 & 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 & Crustal displacement** : Types of slides, causes and effects of lides, rock falls, rock slides, creep, earth flow and subsidence. Prevention of landslides.

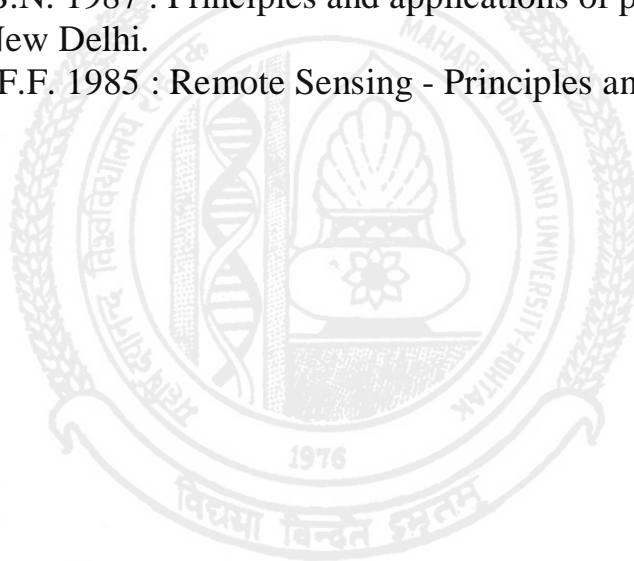
#### **UNIT - IV**

**Continental Drift** : Permanence of land and bisins. Continental drift: slider, Taylor, Wegner. Some recent views & evidences regarding continental drift.

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

#### **BOOKS RECOMMENDED**

1. Principles of Geomorphology by W.D. Thornburry John Wiley.
2. Principles of Physical Geology by Arthur Holmes, Nelson 1969.
3. Gupta R.P. 1990 Remote Sensing Geology, Springer Veriag.
4. Pandey, S.N. 1987 : Principles and applications of photogeology Wiley Eastern, New Delhi.
5. Sabbins, F.F. 1985 : Remote Sensing - Principles and Applications Freeman.



**M.Sc (P) GEOLOGY**  
**(IInd Semester) Paper - 201**  
**Geomorphology & Remote Sensing**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

**WIND** : Its geological action, erosional, transportational and depositional features; applied aspects such as engineering problems in loess and sand dune areas.

**OCEAN** : Geological function of oceans, erosion and deposition as a continuum process along the shore lines. Shorelines of submergence and emergence. Waves,

Tides, currents destruction of shore lines, littoral processes, Erosional & 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 & its related zones erosion, transportation and deposition and their resulting features. Springs, wells, artesian wells, geysers & fumaroles.

**Hydrological cycle** : Rainfall and run off features of rainfall erosion evaporation, transpiration & evapotranspiration processes.

**UNIT-III**

**River** : Erosion, Transportation and deposition and the related geomorphology, growth

& development of river system; drainage & drainage pattern, erosion cycle, river terraces, flood plain & deltas, meandering, rejuvenation and piracy in rivers.

**Lakes** : Description, bogs, swamps, origin of lakes; engineering problems.  
Lakes of India.

**Coral reefs** : Definition & types of coral reefs, characteristics, optimum requirements for their development. Theories on 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 urbanisation; geomorphology and engineering works; geomorphology and hydrology; geomorphology and mineral exploration.

**Remote Sensing** : Principles of remote sensing; general idea about aerial photograph 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 type, identification and interpretation of geographic & tectonic features.

#### BOOKS RECOMMENDED

1. Principles of Geomorphology by W.D. Thornburry John Wiley.
2. Principles of Physical Geology by Arthur Holmes, Nelson 1969.
3. Gupta R.P. 1990 Remote Sensing Geology, Springer Verlag.
4. Pandey, S.N. 1987 : Principles and applications of photogeology Wiley Eastern, New Delhi.
5. Sabbins, F.F. 1985 : Remote Sensing - Principles and Applications Freeman.

**M.Sc (P) GEOLOGY**  
**(Ist Semester) Paper - 102**  
**Structural Geology**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

Stratification, stratified rocks, conformable strata, exposure and outcrops of sedimentary rocks, horizontal beds, vertical beds, simple inclined beds; strike, dip, apparent dip, thickness of beds, trends of outcrops.

**Mechanical Principles and Rock deformation** : Earth forces, static and dynamic

conditions mechanical characteristics of the rocks, kinds of deformation, concept stress and strain diagrams, Hook's law, factors controlling the behaviour 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 folds, symmetric, asymmetric, non-plunging and plunging folds, refolding, fold systems, locally plunging folds, dome and basin fields 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, folds due to vertical movements.

**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 significance of joints.

**Top and Bottom Criteria of Beds :** Significance of various sedimentary structures like ripple marks, ridges and depressions, animal tracks, cross-beddings or current beddings, graded bedding, contemporaneous deformations; features of Igneous rocks, tops 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-textures and internal structure concordant bodies sills, lacoliths, lapoliths, phacoliths etc. discordant intrusive, dykes volcanic vents, batholiths and stocks, granite tectonics.

**Concepts Petrofabric and Symmetry :** Objectives, fields and laboratory interpretation on microscopic and mesoscopic scale preparation of petrofabric diagrams type of fabric, symmetry of fabric and symmetric of movements, their correlation: significance of (pi) and (beta) diagrams.

#### BOOKS RECOMMENDED

1. Badgley, P.C. 1965: , Structure and Tectonics. Harper and Row.
2. Ramsay, J.G., 1967 : Folding and Fracturing of Rocks, McGraw Hill.
3. Ghosh S.K., 1995 : Structural Geology Fundamentals of Modern Developments, Pergamon Press.
4. Turner, F.J. and Weiss, L.E. : Structural Analysis of Metamorphic Tectonites.
5. Billings, M.P. Structural Geology.



**M.Sc (P) GEOLOGY**  
**(IInd Semester) Paper - 202**  
**Structural Geology & Tectonics**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

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

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

**UNIT-II**

**Unconformity** : Kinds of unconformities, recognition of unconformities in outcrops, relation to plutonic rocks, palaeontological criteria, distinguishing faults and unconformities in this field.

**Geophysical Method in Structural Geology** : General outline of various physical character of rocks, general principles of the 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.

**Lincation** : Kinds of lincation, origin of deformed pebbles and oolites, elongated minerals, intersection of bedding and cleavage crinkles, slickensides and mineral streaks, bonding, rodlike and million structures, relation to the major structures.

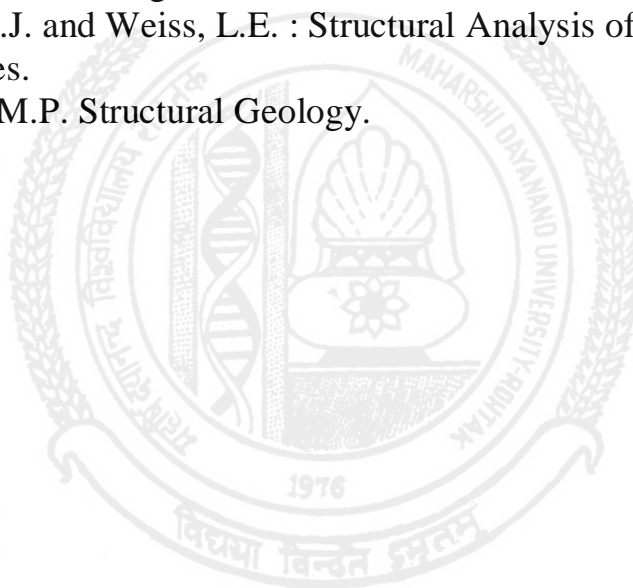
## UNIT-IV

**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 Andean-Himalaya belt, the Appalachian-calidonian belt, the Andies, the North American cordillera.

### BOOKS RECOMMENDED

1. Badgley, P.C. 1965: , Structure and Tectonics. Harper and Row.
2. Ramsay, J.G., 1967 : Folding and Fracturing of Rocks, McGraw Hill.
3. Ghosh S.K., 1995: Structural Geology Fundamentals of Modern Developments, Pergamon Press.
4. Turner, F.J. and Weiss, L.E. : Structural Analysis of Metamorphic Tectonites.
5. Billings, M.P. Structural Geology.



**M.Sc.(P) GEOLOGY**  
**(Ist Semester) – Paper – 103**  
**Crystallography**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

Crystal Elements, Crystal Symmetry; the laws of Crystallography, the common holohedral, himihedral and himimorphic forms in crystallography; Zones; Sterrographic projections; simple mathematical relationship.

**UNIT-II**

**Twinning in Crystals:** The laws of twinning, compositions plane and twin planes, twin axis; various examples of twins in crystals. The symmetry characters and forms of the following classes:- Cubic: Normal, pyrithohedral, tetrahedral and plagiohedral.

**UNIT-III**

**Tetragonal:** Normal, tripyramichal class, pyramidal hemimorphic sphenoidal and trapezohedral. **Hexagonal:** Normal, triphyramidal, pyramidal hemimorphic, trapezohedral, rhombohedral, rhomobohedral hemimorphic, trirhombohedral.

**UNIT-IV**

**Orthorhombic:** Normal, hemimorphic, sphenoidal;  
**Monoclinic:** Normal  
**Triclinic:** Normal.

**BOOKS RECOMMENDED**

1. Dana E.S. and Ford W.E. : A text book of Mineralogy.
2. H.H. Read : Rutle's elements of Mineralogy.
3. Winchall, A.N. Elements of optical Mineralogy.
4. Phillips, Wm, R and Griffen, D.T., 1986 Optical mineralogy, CBS Edition.

**M.Sc.(P) GEOLOGY**  
**(IInd Semester) Paper – 203**  
**Mineralogy**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

**Physical properties of Crystals:** 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 rocks forming silicates.

**Descriptive Mineralogy:** Detail study of rock forming, chemical & optical characters, their occurrence, origin, association and alteration:

**UNIT-II**

Detailed study of rock-forming silicates like, Amphibole, mica feldspar, Scaphite, Felspathoid and Silica groups, their physical, chemical and optical characters, their occurrence, origins, association and alteration.

**UNIT-III**

The mineralogy of metallic ores, Iron manganese, copper, lead, zinc, aluminum, 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, microscopic study of refraction, refractometer, double refraction, classification of crystals into isotropic and anisotropic crystals, the nicol prism and Polaroid plate, polarization of light, interference colors in crystals and determination of their orders, birefringence in biaxial and uniaxial crystals 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; optic axial angle.

### **BOOKS RECOMMENDED**

1. H.H. Read : Rutle's elements of Mineralogy.
2. Winchall, A.N. Elements of optical Mineralogy.
3. Dear, W.A., Howie, R.A. and Zussman, J, 1996 : The rock forming Minerals, Longman.
4. Paul F. Kerr, Optical Mineralogy.



**M.Sc.(P) GEOLOGY**  
**(Ist Semester) Paper – 104**  
**Igneous Petrology**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

**Introduction:** Scope, importance and development of Petrology. Classification of rocks.

**Igneous Petrology:** Magma, its composition, temperature, origins and evolution. Reaction Principle and reaction series.

**UNIT-II**

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

**UNIT-III**

Criteria for classification of Igneous rock, Norms-CIPW and Niggilvalve, Textures and structures of Igneous rocks. Rock suites and series, Petrographic and periods. kindreds of Igneous rocks, Igneous rock association.

**UNIT-IV**

**Petrogenesis of major Igneous rock types:** Such as Basalts, Granites, Alkaline rocks, Pegmatites, Choronoekites.

**BOOKS RECOMMENDED**

1. Turner, F.J. 1980 : Metamorphic Petrology, McGraw Hill, New York.
2. Yardley, B.W. 1989 : An Introduction to Metamorphic Petrology, Longman New York.
3. Best, M.G., 1986 : Igneous Petrology, CBS Publ.
4. McBirney, A.R. 1993 Igneous Petrology, Jones & Barllet Publ.
5. Bose, M.K. 1987 : Igneous Petrology, World Press.

**M.Sc.(P) GEOLOGY**  
**(IInd Semester) Paper – 204**  
**(Metamorphic Petrology & Geochemistry)**

Max. Marks: 80  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

Note:- In all nine questions will be set by the examiner, selecting two questions from each unit. The student will attempt five questions selecting at least one question from each unit. All questions will carry equal marks. Question No.I will be compulsory and will have five to seven parts covering whole of the syllabus.

**UNIT-I**

Processes and kinds of metamorphism. Facies and grades of metamorphicology  
 Textures and structures of metamorphic rocks. Metamorphic minerals & ichoblastic series.

**UNIT-II**

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

**UNIT-III**

Study of the facies of regional metamorphism. Metamorphic dedifferentiation. 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 prospective Sedimentation Classification & characters of sedimentary rocks. Origin of Migmatites, Khondalite and eclogite.

**BOOKS RECOMMENDED**

1. Turner, F.J. 1980 : Metamorphic Petrology, McGraw Hill, 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.

**M.Sc.(P) GEOLOGY**  
**(Ist Semester) Paper – 105**  
**PRACTICAL STRUCTURAL GEOLOGY**

Max. Marks: 50

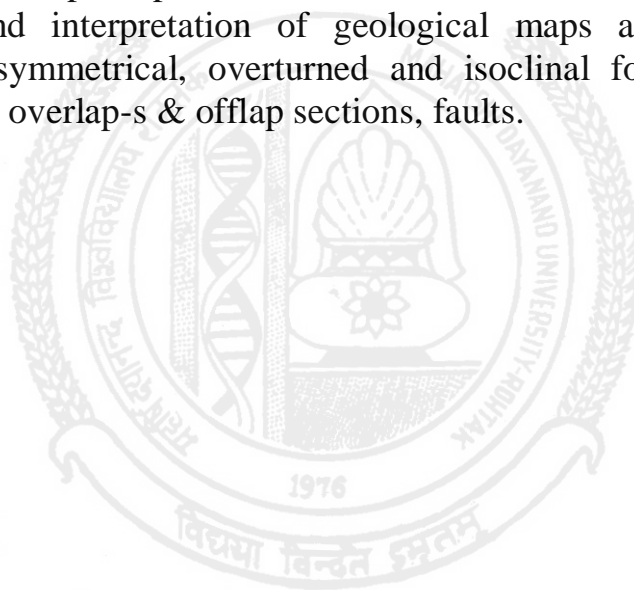
Time: 3 Hrs.

Periods/Week: 4 and half hrs.

Map reading and drawing pertaining to conformable series, horizontal, vertical and inclined beds, patterns 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 & basins, unconformities, overlap-s & offlap sections, faults.





**M.Sc.(P) GEOLOGY**  
**(IInd Semester) Paper – 205**  
**PRACTICAL STRUCTURAL GEOLOGY**

Max. Marks: 50

Time: 3 Hrs.

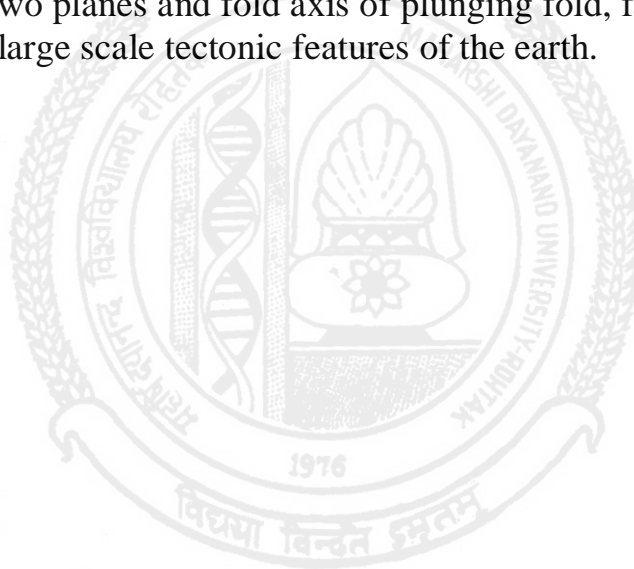
Periods/Week: 4 and half hrs.

Recording & plotting of field data. Preparation & interpretation of structure contour maps, isopach maps, isochore maps, isolith and isograde maps.

Orthographic projection and geometric solution for fault and three point problems.

Stereographic solution of true dip 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.



**M.Sc.(P) GEOLOGY**  
**(Ist Semester) Paper – 106**  
**PRACTICAL CRYSTALOGRAPHY**

Max. Marks: 50  
Time: 3 Hrs.  
Periods/Week: 4 and half 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 & zone symbols in tetragonal, hexagonal and orthorhombic crystals.



**M.Sc.(P) GEOLOGY**  
**(IInd Semester) Paper – 206**  
**PRACTICAL MINERALOGY**

Max. Marks: 50  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

A study of megascopic and microscopic characters of more important rock forming minerals. Determination of refrengence by immersion method using Becke effect, interference colours, pleochroic scheme of biaxial minerals.

Study of conosopic figures of uniaxial kand biaxial crystals using optic axial and acute bisectrix figures.

Determination of extinction angle using sensitive hint plate.

Determination of optic axial ange on the universal state.

**M.Sc.(P) GEOLOGY**  
**(Ist Semester) Paper – 107**  
**PRACTICAL PETROLOGY**

Max. Marks: 50  
 Time: 3 Hrs.  
 Periods/Week: 4 and half hrs.

1. Megascopic and microscopic study of Igneous rocks.
2. Megascopic and microscopic study of Metamorphic rocks of different facies.
3. Interpretation of reaction textures.

**M.Sc.(P) GEOLOGY  
(IInd Semester) Paper – 207  
PRACTICAL PETROLOGY**

Max. Marks: 50  
Time: 3 Hrs.  
Periods/Week: 4 and half hrs.

1. Structures of metamorphic rocks in hand specimen and in thin section.
2. Study of typical rock assemblages in hand specimens and in thin section and their petrogenetic interpretation.
3. Interpretation of chemical analysis of rocks.

**Note:- The practical examination will be conducted annually.**

