FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (Honours School) Geology

(Semester System)

EXAMINATION 2015-2016

--:O:--
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) I Year (Major) in Geology (Semester System) Examination 2015-2016

I Semester Examination, December 2015

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<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Semester Test</th>
<th>End-Semester Examination</th>
<th>Total Marks</th>
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The Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.Sc. 1st year (2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester, he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.
ENVIRONMENT AND ROAD SAFETY EDUCATION (SEMESTER – II)

Note: The syllabus has 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topic from 2 to 11 and one each for the topics 1 and 12 to 15.

1. Environment Concept:
Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Natural resources – their need and types; Principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere:
Types of aquatic systems; Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. Lithosphere:
Earth crust, soil – a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests:
Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, Chipko Andolan.

6. Conservation of Environment:
The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems – soil, water, air, wildlife, forests.

7. Management of Solid Waste:
Merits and demerits of different ways of solid waste management– open dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. Indoor Environment:
Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:
Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity:
What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution:
Pollution due to noise and microbes and their effects.

13. Human Population and Environment:

14. Social Issues:
Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. Local Environmental Issues:
Environmental problems in rural and urban areas. Problem of Congress Grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

Practical
Depending on the available facility in the college, a visit to vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

Examination Pattern:
A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or un-attempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added / included in the final mark sheet.

UNIT II (ROAD SAFETY)
1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

Note: Examination Pattern:
- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted questions).
- The paper shall have two units: Unit I (Environment) and Unit II (Road Safety).
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination: 90 minutes.
- The paper setter is requested to set the questions strictly according to the syllabus.
Suggested Readings
2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

Websites:
(a) www.chandigarhpolice.nic.in
(b) www.punjabpolice.gov.in
(c) www.haryanapolice.gov.in
(d) www.hppolice.nic.in

Note for Theory paper setter:
The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

Syllabi and Courses of Reading

Paper I: PHYSICAL GEOLOGY - (Course No. 101)

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. 101: PHYSICAL GEOLOGY

Objectives: This basic foundational course aims to understand various conceptual aspects of earth’s evolution and its constitution and also to study some important dynamic exogenetic and endogenetic events that shape the earth and its landforms in relation to weathering and depositional processes.

UNIT I
UNIT II

Essential Reading

Further Reading

Paper II: STRUCTURAL GEOLOGY - (Course No. 102)

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. 102: STRUCTURAL GEOLOGY

Objectives: This course introduces the fundamentals of structural geology with main objective is to study in detail the structures related to processes of fracturing.

UNIT I

UNIT II
Joints: general characteristics, joint sets, joint system, major joints and their relation with other structure, use of Rose diagram and sterographic projection, joint intensity. Fault: parts and geometric classification, criterion for recognition of fault. Difference between fault and unconformity. Effects of faulting on outcrop pattern. Throw of the fault, horst and graben.

Essential Reading
Further Reading


Practical I: PHYSICAL GEOLOGY & STRUCTURAL GEOLOGY & FIELD WORK - (Course No. 103P)

Total Marks: [50 (Continuous Assessment M.M. 10, Field Work M.M. 10, End-Semester Exam. M.M. 30)]

Physical Geology: Introduction to map work; types of maps; scales; relief; topographical maps. Physical geology and contours in relation to features produced by river, underground water glacier, wind and ocean.


Field Work: Study of topographical features. Location of position on a topographical map (map reading). Measurements of dip and strike. Study of rocks/minerals in the field, method of collection and labeling of samples. The work done to be presented in the form of Field Report. The marks for the field work will be awarded by the teacher/s who conducted the field work.

A candidate who does not attend the field work or fails to get pass marks in it, will have to get the training by joining the field work tour of the same class (B.Sc. Hons. School I Year) in a subsequent year as per University rules and his/her result in that paper will be withheld.

II Semester Examination, May 2016

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<th>Paper</th>
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<tr>
<td>I</td>
<td>203P</td>
<td>Crystallography &amp; Mineralogy</td>
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Total Marks for B.Sc. (Hons. School) (Major) II Semester (Geology) 200
Note for Theory paper setter:

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

**Syllabi and Courses of Reading**

**Paper I: CRYSTALLOGRAPHY - (Course No. 201)**

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. 201: CRYSTALLOGRAPHY

Objectives: This course aims to understand the basic concepts of crystals and crystal systems, and the characteristics and properties of various crystal systems.

UNIT I

Forms and morphology of crystals; Elements of symmetry; Interfacial angle and its measurements; Law of constancy of interfacial angle; Parameters and indices; Weiss and Miller’s systems of notation; Law of rational indices. Classification of crystals into six crystal systems and principles of classification into 32 classes. Study of holohedral class of cubic crystal system.

UNIT II

Study of holohedral classes and tetragonal, orthorhombic, monoclinic, triclinic and hexagonal crystal systems, and hemihedral classes of hexagonal and cubic crystal systems.

Essential Reading


Further Reading


**Paper II: MINERALOGY – (Course No. 202)**

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. 202: MINERALOGY

Objectives: This course introduces the general physical characters of minerals with an aim to carry out a detailed study of physical properties and chemical compositions of some important rock-forming silicate minerals and some non-silicates.
UNIT I

UNIT II
Physical properties, chemical composition, occurrence and uses of following minerals/groups of minerals: Nesosilicates – titanite, staurolite and chloritoid. Sorosilicates – epidote; Cyclosilicates – beryl, tourmaline and cordierite; Inosilicates – pyroxene group and amphibole group; Phyllosilicates – mica group, talc, serpentine and chlorite; apatite, calcite, barite, fluorite and corundum.

Essential Reading

Further Reading

Practical I: CRYSTALLOGRAPHY & MINERALOGY - (Course No. 203P)

Total Marks: [50 (Continuous Assessment M.M. 10, End-Semester Exam. M.M. 40)]

Crystallography: Clinographic projections and study of element of symmetry of the following crystal modals: Cube, Octahedron, Rhombdodecahedron; Tetrahexahedron, Trisoctahedron and Trapezohedron; Zircon, Barite, Gypsum, Hornblende, Beryl, Calcite, Pyritohedron and Tetrahedron.

Mineralogy: Study of various physical properties of minerals. Study of the following minerals in hand specimen: olivine, garnet, kyanite, andalusite, sillimanite, orthoclase, plagioclase, sodalite, quartz and its varieties, titanite, staurolite, beryl, tourmaline, hypersthene, diopside, augite, anthropylitte, tremolite, actinolite, hornblende, muscovite, biotite, lepidolite, phlogopite, talc, chlorite, serpentine, asbestos, apatite, calcite, barite, fluorite and corundum.
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) I Year (Subsidiary) in Geology (Semester System) Examination 2015-2016

I Semester Examination, December 2015

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<th>Paper</th>
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<td>I</td>
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Total Marks for B.Sc. (Hons. School) (Subsidiary) I Semester (Geology) 100

Note for Theory paper setter:

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

Syllabi and Courses of Reading

Paper I: PHYSICAL GEOLOGY & STRUCTUAL GEOLOGY – (Course Nos. S-101 & S-102)

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. S-101: PHYSICAL GEOLOGY

Objectives: This basic foundational course aims to understand various conceptual aspects of earth’s evolution and its constitution with the major objective is to study some important dynamic exogenetic and endogenetic events that shape the earth and its landforms.

UNIT I


UNIT II

Geological processes: Endogenetic - Elementary idea about plate tectonic theory; Earthquake; Volcanoes. Exogenetic – river, groundwater, glacier, wind and ocean.
Essential Reading


Further Reading


Course No. S-102: STRUCTURAL GEOLOGY

Objectives: This course introduces the basic concepts of structural geology with the main objective is to study in detail the structures related to process of fracturing.

UNIT I
Introduction: Stratification, dip and strike, stratum contour, clinometer compass and brunton compass, bearing and back bearing. Thickness and width of outcrops, effects of topography on outcrop pattern, outlier, inlier. Unconformities: significance, types and recognition of unconformities. Folds: parts of fold, types and classification; recognition and representation of folds; Methods of determination of top and bottom of beds.

UNIT II
Joints: general characteristics, joint sets, joint system, major joints and their relation with other structure Fault: parts and geometric classification, criterion for recognition of fault. Difference between fault and unconformity. Effects of faulting on outcrop pattern. Throw of the fault; horst, graben, thrust, nappe, window and Klippe

Essential Reading


Further Reading


Practical I: PHYSICAL GEOLOGY & STRUCTURAL GEOLOGY- (Course No. S-103P)

Total Marks: [25 (Continuous Assessment M.M. 5, End-Semester Exam. M.M. 20)]


Structural Geology: Problems of dip and strike; Problems involving thickness of beds and width of outcrop. Completion of outcrops. Delineation of simple structures: unconformity, folds and Faults. Geological section drawing; thickness of beds; sequence of events; throw of the fault.
II Semester Examination, May 2016

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<th>Paper</th>
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Total Marks for B.Sc. (Hons. School) (Subsidiary) II Semester (Geology) 100

Note for Theory paper setter:

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

_Syllabi and Courses of Reading_

**Paper I: CRYSTALLOGRAPHY & MINERALOGY – (Course Nos. S-201 & S-202)**

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

**Course No. S-201: CRYSTALLOGRAPHY**

**Objectives:** This course aims to understand the basic concepts of crystals and crystal systems and also provides the characteristics and properties of various crystal systems.

**UNIT I**
Forms and morphology of crystals; Elements of symmetry; Interfacial angle and its measurements; Law of constancy of interfacial angle; Parameters and indices; Weiss and Miller’s systems of notation; Law of rational indices. Classification of crystals into six crystal systems and principles of classification into 32 classes. Study of holohedral class of cubic crystal system.

**UNIT II**
Study of holohedral classes and tetragonal, orthorhombic, monoclinic, triclinic and hexagonal crystal systems, and hemihedral classes of hexagonal and cubic crystal systems.

**Essential Reading**
Further Reading


Course No. S-202: MINERALOGY

Objectives: This course introduces the general physical characters of minerals with an aim to carry out a detailed study of physical properties and chemical compositions of some important rock-forming silicate minerals and some non-silicates.

UNIT I
Introduction and scope of mineralogy. Physical characters of minerals: form, cleavage, parting, fracture, luster, colour, streak, hardness and specific gravity. Physical properties, chemical composition, occurrence and uses of following minerals/groups of minerals: feldspar group, feldspathoid group, silica group, olivine group, garnet group, zircon and aluminium silicate group.

UNIT II
Physical properties, chemical composition, occurrence and uses of following minerals/groups of minerals: titanite, staurolite and chloritoid; epidote; beryl, tourmaline and cordierite; pyroxene group and amphibole group; mica group, talc, serpentine and chlorite; apatite, calcite, barite, fluorite and corundum.

Essential Reading


Further Reading


Practical I: CRYSTALLOGRAPHY & MINERALOGY - (Course No. S-203P)

Total Marks: [25 (Continuous Assessment M.M. 5, End-Semester Exam. M.M. 20)]

Crystallography: Clinographic projections and study of element of symmetry of the following crystal modals: Cube, Octahedron, Rhombdodecahedron; Tetrahedron, Trisoctahedron, Trapezohedron; Zircon, Barite, Gypsum, Hornblende, Beryl, Calcite, Pyritohedron and Tetrahedron.

Mineralogy: Study of various physical properties of minerals. Study of the following minerals in hand specimen: olivine, garnet, kyanite, andalusite, sillimanite, orthoclase, plagioclase, sodalite, quartz and its varieties; titanite, staurolite, beryl, tourmaline, hypersthene, diopside, augite, anthophyllite, tremolite, actinolite, hornblende, muscovite, biotite, lepidolite, phlogopite, talc, chlorite, serpentine, asbestos, apatite, calcite, barite, fluorite and corundum.
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) II Year (Major) in Geology (Semester System) Examination 2015-2016

III Semester Examination, December 2015

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<td>I</td>
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Total Marks for B.Sc. (Hons. School) (Major) III Semester (Geology) 300

Note for Theory paper setter:

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 or 80 marks as the case may be, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 or 15 marks each, are to be attempted by the students from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

Syllabi and Courses of Reading

Paper I: PETROLOGY & STRUCTURAL GEOLOGY- (Course Nos. 301 & 302)

Total Marks: [100 (Mid-Semester Test M.M. 20, End-Semester Exam. M.M. 80)]

Course No. 301: PETROLOGY

Objectives: This course introduces the fundamentals of petrology in order to have a broad idea of forms, textures, structures and classification of igneous, metamorphic and sedimentary rocks.

UNIT I

Introduction to petrology. Igneous petrology: introduction to magma; igneous environments; forms and structures of extrusive and intrusive igneous rocks; igneous textures; classification (mineralogical including IUGS and chemical) and nomenclature of igneous rocks; and petrography of common igneous rocks. Sedimentary petrology: formation of sediments; types and formation of sedimentary rocks (siliciclastic, biochemical, organic and chemical); sedimentary structures; and
diagenesis. Metamorphic petrology: definition of metamorphism; limits and types of metamorphism; metamorphic agents; types of metamorphic protoliths; textures and structures; and classification and names of metamorphic rocks.

Essential Reading


Further Reading


Course No. 302: STRUCTURAL GEOLOGY

Objectives: The main aim of this course is to appraise the structures related to deformation and tectonics along with an overview of theory of plate tectonics.

UNIT II
Mechanical principles of rocks deformation; introduction to stress and strain; factors controlling behaviour of rocks; mechanism and causes of folding; Faults: mechanics of faulting; Introduction to Thrust, Nappe, Klippe and window. Diapers and related structure; foliation: definition and types; origin of slaty cleavage, its relationship with bedding; lineations: definition, types, origin and significance; liner structures; structures of plutons: definition, classification and mode of emplacement; diastrophism: orogency and epirogeny; continental drift; plate tectonics: major lithospheric plates of the globe and their boundaries.

Essential Reading


Further Reading


Paper II: PALAEONTOLOGY - (Course No. 303)

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. 303: PALAEONTOLOGY

Objectives: After providing an overview of basic concepts of fossils, the main objective of this course is to understand the morphological and other evolutionary details of important invertebrate phyla.
UNIT I
Introduction to Palaeontology; Fossils: definition, significance and applications; processes of fossilisation; morphology, taxonomy, palaeoenvironments, geological distribution and evolutionary history of Phylum Mollusca (classes: Bivalvia, Gastropoda and Cephalopoda).

UNIT II
Morphology, taxonomy, palaeoenvironments, geological distribution and evolutionary history of Phylum Brachiopoda, Arthropoda (class: Trilobita) and Echinodermata (Classes: Echinidea and Crinoidea).

Essential Reading

Further Reading

Practical I: PETROLOGY & STRUCTURAL GEOLOGY - (Course No. 304P)
Total Marks: [75 (Continuous Assessment M.M.15, End-Semester Exam. M.M. 60)]


Practical II: PALAEONTOLOGY - (Course No. 305P)
Total Marks: [50 (Continuous Assessment M.M.10, End-Semester Exam. M.M. 40)]

Palaeontology: Identification of representative genera of the following Phyla:

Mollusca: Pelecypoda, Gastropoda and Cephalopoda; Brachiopoda, Arthropoda, Echinodermata

Detailed morphology of the following: Arca Gryphaea, Turritella, Turbo, Nautilus, Perisphinctes, Rhynconella and Terebratula.
IV Semester Examination, May 2016

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<th>Paper</th>
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**Note for Theory paper setter:**

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 or 80 marks as the case may be, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 or 15 marks each, are to be attempted by the students from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

**Syllabi and Courses of Reading**

**Paper I: STRATIGRAPHY & GEOMORPHOLOGY - (Course Nos. 401 & 402)**

Total Marks: [100 (Mid-Semester Test M.M. 20, End-Semester Exam. M.M. 80)]

**Course No. 401: STRATIGRAPHY**

**Objectives:** The aim of this course is first to understand the principles and fundamentals of stratigraphy, and based on this knowledge, the stratigraphy of Mesozoic, Cenozoic and non-marine Paleozoic sequences in India are studied.

**UNIT I**

Principles of Stratigraphy; stratigraphic correlation; stratigraphic classification and code of stratigraphic nomenclature; facies: classification and environments of deposition; sequence and event stratigraphy; Geological and evolutionary episodes through time; Mesozoic and Cenozoic Eras: subdivisions, sedimentary basins, stratigraphy, biotas, palaeogeography and
palaeoenvironments; Gondwana Supergroup: stratigraphic successions, correlations, biotas, palaeogeography and palaeoclimates.

**Essential Reading**


**Further Reading**


**Course No. 402: GEOMORPHOLOGY**

**Objectives:** The aim of this course is to understand fundamentals of geomorphology, and role of structure, lithology and natural processes in evolution of landforms.

**UNIT II**

Fundamental concepts of geomorphology; drainage patterns; landforms and their evolution: structural and lithological controls, karst topography; palaeogeomorphology; neotectonics; mountain-morphology and classification; Himalayan mountain chains; glaciation and glacial periods; desertification: processes and products; coastal geomorphology; geomorphological features of India.

**Essential Reading**


**Further Reading**

S. Chand Company Ltd., New Delhi

**Paper II: OPTICAL MINERALOGY - (Course No. 403)**

**Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]**

**Course No. 403: OPTICAL MINERALOGY**

**Objectives:** This course introduces the concepts and fundamentals of optical mineralogy with an ultimate aim to identify the minerals in thin sections.

**UNIT I**

Nature of light: polarized light and crossed polarized light; polarising light microscope (PLM): its parts and functioning; reflection, critical angle; total reflection and refraction; refractive index and Snell’s law, dispersion; relief; Becke line; isotropic and anisotropic minerals; pleochroism;
extinction and its measurement; interference colours; birefringence and retardation; Optical properties of nesosilicates, sorosilicates and cyclosilicates.

UNIT II
Optical properties of inosilicates, phyllosilicates and tektosilicates; Optic indicatrix in isoaxial, uniaxial and biaxial minerals; quartz wedge, mica plate and gypsum plate and their uses; formation of uniaxial and biaxial interference figures and determination of optic sign; sign of elongation; determination of anorthite content of plagioclase.

Essential Reading

Further Reading

Practical I: STRATIGRAPHY, GEOMORPHOLOGY & OPTICAL MINERALOGY – (Course No. 404P)

Total Marks: [100 (Continuous Assessment M.M.20, End-Semester Exam. M.M. 80)]

Stratigraphy: Introduction to the geological map of India and distribution of sedimentary basins in stratigraphic context. Palaeogeographic maps of Mesozoic and Cenozoic Eras of India. Examination of selected representative hand specimens of Mesozoic and Cenozoic rocks and fossils of India and their chronological arrangement.

Geomorphology: Study of Drainage Pattern, Qualitative and quantitative drainage analysis.

Optical Mineralogy: Optical characters and identification of the following minerals under the microscope: Quartz, orthoclase, microcline, plagioclase, muscovite, biotite, hornblende, augite, olivine, andalusite, kyanite, sillimanite, garnet, staurolite and calcite. Determination of anorthite content of plagioclase. Determination of optic sign. Determination of sign of elongation.

GEOLOGICAL FIELD WORK – (Course No. 405 FW) Total Marks: 25

The duration of field work would be about one week. The main objective of the field work would be the preparation of a geological traverse map. Study of rocks/minerals/fossils in the field and collection of representative samples. The work done to be presented in the form of a Field Report. The marks for field work and the report will be awarded by the teacher(s) who conducted the field work.

A candidate who does not attend field work or fails to get pass marks in it will have to do the field work by joining the field tour of the same class (B.Sc. Hons School II Year) in a subsequent year as per university rule.
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) II Year (Subsidiary) in Geology (Semester System) Examination 2015-2016

III Semester Examination, December 2015

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Total Marks for B.Sc. (Hons. School) (Subsidiary) III Semester (Geology) 100

Note for Theory paper setter:

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

Syllabi and Courses of Reading

Paper I: PETROLOGY & PALAEONTOLOGY – (Course Nos. S-301 & S-302)

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

Course No. S-301: PETROLOGY

Objectives: This course introduces the fundamentals of petrology in order to have a broad idea of forms, textures, structures and classification of igneous, sedimentary and metamorphic rocks.

UNIT I

Introduction to igneous rocks; magma and lava; igneous environments; types of intrusives: sill, dyke, lacolith, lopolith, batholith and stock; types of extrusives: ropy-, blocky- and pillow lava; igneous textures based on degree of crystallinity, granularity and fabric; igneous structures; mineralogical, chemical and tabular classification of igneous rocks.

Metamorphism; types of metamorphism: contact and regional (burial-, dynamothermal- and ocean-floor metamorphism); mylonitisation. Metamorphic textures based on shape and fabric of metamorphic minerals; metamorphic structures: foliation, cleavage, schistosity and gneissosity. Introduction to detrital rocks; shape and rounding of grains; cohesion: welding or indurations and
cementation; factors effecting mineral composition of sediments; factors determining the grain size of sedimentary rocks; Wentworth classification for clastic sedimentary rocks; classification of sedimentary rocks based on grade size; sedimentary structures: stratification, graded bedding, ripple marks, mud cracks, rain imprints and mounds, fossil shells and animal tracks; agents and location of deposition of sediments.

**Essential Reading**


**Further Reading**


Course No. S-302: PALAEONTOLOGY

**Objectives:** After providing an overview of basic concepts of fossils, the main objective of this course is to understand the morphological details of some important invertebrate phyla, and also a few plant and vertebrate fossils.

**UNIT II**

Modes of preservation, stratigraphic significance and application of fossils. A brief study of the following groups: Bivalvia, Gastropoda, Cephalopoda Brachiopoda, Trilobites, Corals, Echinodermata and Graptolites. Study of selected genera of plant and vertebrate fossils.

**Essential Reading**


**Further Reading**


**Practical I: PETROLOGY & PALAEONTOLOGY— (Course No. S-303P)**

Total Marks: [25 (Continuous Assessment M.M. 5, End-Semester Exam. M.M. 20)]

**Petrology:** Megascopic study of the following igneous, metamorphic and sedimentary rocks: granite, pegmatite, syenite, diorite, granodiorite, gabbro, rhyolite, obsidian, dacite, trachyte, andesite, basalt; conglomerate, sandstone, limestone, dolomite, shale; quartzite, phyllite, slate, marble, schist and gneiss.
**Palaeontology:** Identification of representative genera of Mollusca, Brachiopoda, Trilobites, Corals, Echinodermata and Graptolites.

IV Semester Examination, May 2016

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**Total Marks for B.Sc. (Hons. School) (Subsidiary) IV Semester (Geology) 100**

**Note for Theory paper setter:**

The theory question paper for the end-semester examination will have seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which is compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the whole syllabus. The remaining 4 questions carrying 10 marks each, are to be attempted from the 2 Units, selecting two questions from each unit. Each unit would comprise of three questions.

**Syllabi and Courses of Reading**

**Paper I: ECONOMIC GEOLOGY & STRATIGRAPHY – (Course Nos. S-401 & S-402)**

Total Marks: [75 (Mid-Semester Test M.M. 15, End-Semester Exam. M.M. 60)]

**Course No. S-401: ECONOMIC GEOLOGY**

**Objectives:** The purpose of this course is to first have an overview of various ore-forming processes, and then to study some important occurrences of metallic and non-metallic deposits of India.

**UNIT I**

General idea of the important ore forming processes. Indian mineral occurrences of ores of iron, manganese, aluminium, lead, zinc and copper; magnesite, mica, atomic minerals, coal, petroleum, abrasives, fertilizers and building stones.

**Essential Reading**

Further Reading


Course No. S-402: STRATIGRAPHY

Objectives: The aim of this course is to understand the principles and fundamentals of stratigraphy, and also the stratigraphy of Precambrian and Phanerozoic sequences in India.

UNIT II

Essential Reading


Further Reading


Practical I: ECONOMIC GEOLOGY & STRATIGRAPHY – (Course No. S-403P)

Total Marks: [25 (Continuous Assessment M.M. 5, End-Semester Exam. M.M. 20)]

Economic Geology: Study of hand specimens of ores of iron, manganese, aluminium, lead, zinc and copper; magnesite, mica, atomic minerals, abrasives, phosphorites and building stones.

Stratigraphy: Precambrian geological maps of India. A study of Precambrian specimens, and their chronological arrangement. Paleozoic, Mesozoic and Cenozoic geological maps of India. A study of Paleozoic, Mesozoic and Cenozoic rocks and fossils specimens, and their chronological arrangement.
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) III Year (Major) in Geology (Semester System) Examination 2015-2016

V Semester Examination, December 2015

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<td>IV</td>
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Total Marks for B.Sc. (Hons. School) (Major) V Semester (Geology)  500

Note for paper Theory paper setter:

The question paper for the end-semester examination in each theory paper will have seven questions. Each question paper will be of 60 marks, with 20 marks for first question (10 short answer questions, without any choice, covering the whole syllabus), i.e. the compulsory question, and 10 marks for each of the four questions to be attempted by the students from the 2 Units, selecting two questions from each units.
Syllabi and Courses of Reading

PAPER I: IGNEOUS PETROLOGY (Course No. 501)
Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 501: IGNEOUS PETROLOGY

Objectives: The aim of this course is to understand the crystallization behaviour of magmas and various processes of magmatic differentiation.

UNIT I
Generation of melts (melting of mantle and factors controlling melting of mantle); Interior of earth: Temperature and pressure gradients, factors controlling pressure and temperature gradients; Properties of Magma: composition of magma, volatiles in magma, temperature and other thermal properties, viscosity & density; Effects of cooling and crystallization; Rise of magma, convection in magma; The Mantle: physical characteristics, chemistry, mineralogy and petrology; Meteorites: composition and types.

UNIT II
Basic principles of thermodynamics: system, equilibrium, phase, component, entropy, chemical potential, phase rule and variance. One component system (SiO$_2$ system); Binary systems (solid solution: Albite-Anorthite and Forsterite-Fayalite systems; eutectic: Diopside-Anorthite system; peritectic: Forsterite-Silica system; solid solution and eutectic: Alkali feldspar system); Ternary systems (eutectic: Anorthite-Diopside-Forsterite system; solid solution and eutectic: Diopside-Albite-Anorthite system). Magmatic processes of magma diversification: differentiation, fractional crystallisation, volatile transport, liquid immiscibility, magma mixing and assimilation.

Essential Reading

Further Reading
Paper II: METAMORPHIC PETROLOGY (Course No. 502)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No.502: METAMORPHIC PETROLOGY

Objectives: In addition to comprehend some more basic principles, the main aim of this course is to understand the classification of metamorphic rocks and the nature and type of metamorphism of divergent protoliths.

UNIT I

Metamorphic recrystallisation: initiation of metamorphism, increase in grain size and growth of metamorphism; The progressive nature of metamorphism; Mineral assemblages and mineral parageneses; Chemical behaviour of metamorphic rocks; Graphic representation of mineral assemblages on phase diagrams (ACF, AKF and AFM); Metamorphic grade: mineral zones, index minerals and isograd.

UNIT II

Metamorphic facies and their study. Metamorphism of argillaceous, arenaceous, mafic and calcareous rocks. Metasomatism; Migmatites.

Essential Reading


Further Reading


Paper-III: SEDIMENTOLOGY (Course No.503)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No.503: SEDIMENTOLOGY

Objectives: The prime aim of this course is to understand the role of mineralogy, textures and structures to decipher provenance and environment of deposition of sediments.
UNIT I
Liberation and flux of sediments, processes of transport and deposition. Detailed study of sedimentary structures (physical, chemical & biogenic) and their interpretation. Petrography of sandstone and limestone. Genesis and classification of sedimentary rocks (clastic & non-clastic).

UNIT II
Provenance, maturity and stability of sediments. Heavy mineral studies. Sedimentary environments and facies (both macro and micro) in space and time. Lithification and diagenesis in both clastic and nonclastic rocks. Dolomitisation and de-dolomitisation, phosphatization.

Essential Reading

Further Reading

Paper-IV: STRATIGRAPHY (Course No. 504)
Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 504: STRATIGRAPHY

Objectives: This course aims to understand the major Archean-proterozoic and palaeozoic successions in relation to lithostratigraphy and their basinal correlations of Peninsular India and Himalayan domains.

UNIT I
Precambrian stratigraphic successions and correlative equivalents in Dharwar, Eastern Ghats, South India, Singhbum, Central India (Nagpur-Bhandara-Chhindwara) and Aravalli-Delhi belt. Proterozoic correlative equivalents in the Himalayan regions of Kashmir, Kumaun, Himachal Pradesh and the Northeast. Lithostratigraphic successions, biotas and correlations of Cuddapah Supergroup in the Kurnool, Kaladgi, Bhima and Pakhal-Albaka basins.

UNIT II
Lithostratigraphic successions and correlations of Vindhyan Supergroup along with their fossil biotas and palaeoenvironmental significance. Palaeozoic stratigraphy of the stratotypes in the Tethyan basins of Kashmir, Spiti, Ladakh and Kumaun-Garhwal with particular reference to biotas, palaeoenvironmental implications and biocorrelations. Palaeozoic stratigraphy of the Lesser Himalaya and Peninsular India.
Essential Reading


Further Reading


Practical I: IGNEOUS PETROLOGY AND METAMORPHIC PETROLOGY- (Course No. 505P)

Total Marks: 75 (Continuous assessment M.M. 15, End Semester Exam. M.M. 60)

Igneous Petrology: Systematic megascopic and microscopic study of the following rock types: granite, granodiorite, rhyolite, diorite, andesite, syenite, gabbro, dolerite, basalt, dunite.

Metamorphic Petrology: Study of texture, structure, mineralogy and identification of thermally and regionally metamorphosed common argillaceous, carbonate and mafic rocks.

Practical II: SEDIMENTOLOGY AND STRATIGRAPHY (Course No. 506P)

Total Marks: 75 (Continuous assessment M.M. 15, End Semester Exam. M.M. 60)

Sedimentology: Detailed hand specimen and microscopic study of sedimentary rocks: conglomerate, sandstone, shale, limestone, mudstone, phosphorite, rock salt, quartzite and siltstone.

Stratigraphy: Study of some selected stratigraphic samples from Precambrian and Palaeozoic sequences of India; Indian palaeogeographic maps of Palaeozoic era.

FIELD WORK (Course No. 507FW) - Total Marks: 50

Geological Field Work: The duration of field work would be about two weeks. The field work would consist of geological mapping in a selected area having simple structure for about a week; visit to mineralized area/mine/fossiliferous area and its field study and collection of representative samples. It is mandatory for the students to maintain a systematic field diary and collect good geological samples. The marks for field work will be awarded by the teacher who conducted the field work.
A candidate who does not attend the field work or fails to get pass marks in it will have to do the Field Work by joining the field of the same class (B.Sc. Hons School III Year) in a subsequent year as per University rules.

**Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) III Year (Major) in Geology (Semester System) Examination 2015-2016**

**VI Semester Examination, May 2016**

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**Total Marks for B.Sc. (Hons. School) III Year (Major) VI Semester (Geology) 500**

**Note for Theory paper setter:**

The question paper for the end-semester examination in each theory paper will have seven questions. Each question paper will be of 60 marks, with 20 marks for first question (10 short answer questions, without any choice, covering the whole syllabus), i.e. the compulsory question, and 10 marks for each of the four questions to be attempted by the students from the 2 Units, selecting two questions from each units.
Syllabi and Courses of Reading

Paper I: PALAEONTOLOGY (Course No. 601)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 601: PALAEONTOLOGY

Objectives: This course aims to understand morphotaxonomy of some advanced invertebrate phyla and concepts of vertebrate evolution along with palaeobotanical aspects.

UNIT I
Invertebrate Paleontology: Detailed study of morphotaxonomy, evolutionary trends, geologic history and environmental significance of Phyla: Cnidaria (Anthozoa-Corals), Hemichordata (Graptolites). Micropalaeontology: A brief account of microfossil groups.

UNIT II


Essential Reading
Further Reading

Paper II: ECONOMIC GEOLOGY-I (Course No. 602)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 602: ECONOMIC GEOLOGY-I

Objectives: This course is aimed to provide an overview of basics of ore properties and a detailed study of formation of mineral deposits.

UNIT I

UNIT II

Essential Reading

Further Reading

Paper-III: ECONOMIC GEOLOGY-II (Course No.603)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 603: ECONOMIC GEOLOGY-II

Objectives: This course focuses on Indian distribution and genesis of various metallic and non-metallic deposits.
UNIT I
Mode of occurrence and Indian distribution of following metallic deposits: ferrous (iron, manganese and chromite), non-ferrous (copper, lead, zinc, tin and aluminium) and precious (gold, silver and platinum) metals.

UNIT II
Properties (physical and chemical.), mode of occurrence, uses and Indian distribution of following non-metallic deposits: Minerals for chemical Industries (sulphur, pyrite, barite, fluor spar and salt), Minerals for Glass and Ceramic industries (gypsum, talc, feldspar, glass sand and clays), Minerals for Refractory Industries (graphite, dolomite, magnesite, Al-silicates, fire clays and ball clays) Minerals for Fertilizer Industries (rock phosphate, sulphur and gypsum), Minerals for Electrical Industries (mica, asbestos, mineral wool and glass wool), Precious and Semi-Precious minerals (diamond, ruby, sapphire, emerald, aquamarine, zircon, topaz and garnet), Minerals for Abrasive, Pigment and Filler material.

Essential Reading

Further Reading
Indian Minerals Year Book. Govt. of India Publication.

Paper IV: APPLIED GEOLOGY (Hydrogeology, Mining Geology & Field Geology) – (Course No. 604)

Total Marks: 75 (Mid Semester Test M.M. 15, End-Semester Exams. M.M. 60)

Course No. 604: APPLIED GEOLOGY (Hydrogeology, Mining Geology & Field Geology)

Objectives: Main objective of the course is to introduce elementary hydrogeology, mining geology and also to understand the use of various methods and instruments for surveying and mapping.

UNIT I

UNIT II
processes of coal washing in India. Indian example of ore dressing practices: Iron ore Noamudi mining, Zawar Lead-zinc, Mosabani Copper mines. Environmental effects of mining. An introduction to prospecting and exploration of mineral deposits.

Field Geology: Methods of geological mapping: Mapping rock units and structures - a geological traverse; recording of sedimentary structures; preparation of lithologs; geological mapping on topographic base; geotechnical mapping. Geological surveys: plane table, theodolite and electronic total station.

Essential Reading

Further Reading

Practical I: PALAEONTOLOGY (Course No. 605P)

Total Marks: 50 (Continuous assessment M.M. 10, End-Semester Exam. M.M. 40)

Paleontology: Morphotaxonomy of some selected genera of cnidarians, graptolites, archaeocyathids, Foraminifera (larger and smaller) and Ostracoda. Thin section studies of dental and bone histology and morphotaxonomical studies of some selected genera of Equidae and Proboscideans. Morphological study of some selected Lower and Upper Gondwana plant fossils.

Practical II: ECONOMIC GEOLOGY AND APPLIED GEOLOGY (Course No. 606P)

Total Marks: 100 (Continuous assessment M.M. 20, End-Semester Exam. M.M. 80)

Economic Geology: Systematic study of the physical properties of the following metallic and non-metallic minerals: iron, manganese, chromium, copper, lead-zinc, tin and aluminium ores; minerals for chemical-, refractory-, fertilizer- and insulation & electrical-industries.

Applied Geology: Hydrogeology: Preparation of depth-to-water maps, water table contour maps and electrical conductivity maps. Mining Geology: Introduction to methods and problems of assaying of ores of base metals, tenors and grades; calculations and interpretation of such data. Field Geology: Surveying and geological mapping with Plane Table and alidade. Electronic total station.

FIELD WORK (Course No. 607 FW)


Field Report & Viva voce: The students will prepare a well illustrated field report based on the field work conducted in the previous semester. A board of examiners will evaluate the field report and conduct the viva-voce and would consist of the Chairman or his nominee, the faculty member(s) who conducted the field work and three other faculty members appointed by the Board of Control.
A candidate who does not submit the field work and/or does not attend the viva-voce examinations of fails to get pass marks in it, will have to resubmit the report or attend the viva-voce examination as the case may be of the same class (B.Sc.(Hons. School III year) in a subsequent year as per University rules.