FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL) GEOLOGY

3rd TO 6th SEMESTER

EXAMINATIONS 2016-2017

--:O:--
Outlines of Tests, Syllabi and Courses of Reading for B.Sc. (Honours School) II Year (Major) in Geology (Semester System) Examinations 2016-17, 2017-18 and 2018-19

III Semester Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Semester Test</th>
<th>End-Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>301</td>
<td>Petrology &amp; Structural Geology</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>302</td>
<td>Petrology &amp; Structural Geology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>303</td>
<td>Palaeontology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
</tbody>
</table>

| Practical | Continuous Assessment |                              |                   |                          |             |
| I         | 304P   | Petrology & Structural Geology | 15                | 60                       | 75          |
| II        | 305P   | Palaeontology                 | 10                | 40                       | 50          |

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 consist of 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 would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 or 15 marks each, shall 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; linear structures; structures of plutons: definition, classification and mode of emplacement; diastrophism: orogeny and epigeny; 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: Echinodea 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

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Semester Test</th>
<th>End-Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory I</td>
<td>401</td>
<td>Stratigraphy &amp; Geomorphology</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>402</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory II</td>
<td>403</td>
<td>Optical Mineralogy</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>Practical</td>
<td></td>
<td>Continuous Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical I</td>
<td>404P</td>
<td>Stratigraphy, Geomorphology &amp; Optical Mineralogy</td>
<td>20</td>
<td>80</td>
<td>100</td>
</tr>
<tr>
<td>Field Work</td>
<td></td>
<td>No Continuous Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Work</td>
<td>405FW</td>
<td>Geological Field Work</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Total Marks for B.Sc. (Hons. School) (Major) IV Semester (Geology)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
</tbody>
</table>

**Note for Theory paper setter:**

The theory question paper for the end-semester examination will consist of 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 would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 or 15 marks each, shall 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)**

**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; birefrenge 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) Examinations 2016-17, 2017-18 and 2018-19

III Semester Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Semester Test</th>
<th>End-Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>S-301</td>
<td>Petrology &amp; Palaeontology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>S-302</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical</th>
<th>Continuous Assessment</th>
<th>S-303P</th>
<th>Petrology &amp; Palaeontology</th>
<th>5</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
</table>

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 consist of seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 marks each, shall 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 & 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 Ns. 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

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Semester Test</th>
<th>End-Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>I</td>
<td>S-401 Economic Geology &amp; Stratigraphy</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>S-402 Economic Geology &amp; Stratigraphy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practical</td>
<td>Continuous Assessment</td>
<td>I</td>
<td>S-403P Economic Geology &amp; Stratigraphy</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

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 consist of seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 marks each, shall 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: 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 Ns. 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) Examinations 2016-17, 2017-18 and 2018-19

V Semester Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid Semester Test</th>
<th>End Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>501</td>
<td>Igneous Petrology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>502</td>
<td>Metamorphic Petrology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>503</td>
<td>Sedimentology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>504</td>
<td>Stratigraphy</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practical</th>
<th>Continuous Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>505P Igneous Petrology &amp; Metamorphic Petrology 15 60 75</td>
</tr>
<tr>
<td>II</td>
<td>506P Sedimentology &amp; Stratigraphy 15 60 75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Work</th>
<th>No Continuous Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>507FW Geological Field Work</td>
<td>50</td>
</tr>
</tbody>
</table>

Total Marks for B.Sc. (Hons. School) (Major) V Semester (Geology) 500

Note for paper Theory paper setter:

The theory question paper for the end-semester examination will consist of seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 marks each, shall 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: 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, Singhbhum, 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 Precambrain 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) Examinations 2016-17, 2017-18 and 2018-19

VI Semester Examination

<table>
<thead>
<tr>
<th>Paper</th>
<th>Course</th>
<th>Title</th>
<th>Mid Semester Test</th>
<th>End Semester Examination</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>601</td>
<td>Palaeontology</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>II</td>
<td>602</td>
<td>Economic Geology-I</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>III</td>
<td>603</td>
<td>Economic Geology-II</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>IV</td>
<td>604</td>
<td>Applied Geology (Hydrogeology, Mining Geology &amp; Field Geology)</td>
<td>15</td>
<td>60</td>
<td>75</td>
</tr>
</tbody>
</table>

| Practical | Continuous Assessment | | | |
|-----------|------------------------| | | |
| I         | 605P Palaeontology     | 10 | 40 | 50 |
| II        | 606P Economic Geology & Applied Geology (Hydrogeology, Mining Geology & Field Geology) | 20 | 80 | 100 |

**Field Work**

| Field Work | No Continuous Assessment | | |
|------------|---------------------------| | |
| 607FW      | Geological Field Report  | 25 | 50 |
|            | Viva voce                | 25 |

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

**Note for Theory paper setter:**
The theory question paper for the end-semester examination will consist of seven questions. Each question paper will be of 60 marks, with 20 marks reserved for first question, which would be compulsory. Further, the latter would comprise of 10 short answer questions, without any choice, covering the entire syllabus. The remaining 4 questions carrying 10 marks each, shall 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: 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 Palaeontology: 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
Origin, occurrence and distribution of water: Water on earth; Types of water; Hydrological Cycle and its components; Water balance; Water-bearing properties of rocks — porosity, permeability, specific yield and specific retention; Vertical distribution of water; Zone of aeration and zone of saturation; Classification of rocks according to their water-bearing properties; Concepts of drainage basins and groundwater basins; Aquifer parameters- transmissivity, storage coefficient, hydraulic conductivity, transmittivity, hydraulic resistance and likage factor; Water table and piezometric surface; Fluctuations of water table and piezometric surface; Water table contour maps; Hydrographs; Springs; Geologic and geomorphic controls on groundwater.

Groundwater Hydraulics: Theory of groundwater flow; Darcy's law and its applications; Determination of permeability in laboratory and in field; Flow through aquifers; steady, unsteady and radial flow conditions; Evaluation of aquifer parameters of confined, semi-confined and unconfined aquifers – brief idea about Thiem, Thies, Jacob and Walton's methods; Fundamental concept of Groundwater modeling.
UNIT II


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: Exercise Numerical Problems - porosity, permeability, specific yield and specific retention, storage coefficient, hydraulic conductivity, transmissivity, hydraulic resistance and likage factor. Preparation of depth-to-water maps, water level fluctuation and water table contour maps and determination of hydraulic gradient and groundwater flow direction.

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. Only the latter would evaluate the field report and submit the marks independently to the Chairman, and similarly, they would also award the marks of viva-voce independently. In both the cases, i.e. marks of field report and voce-voce, an average value of three, will be considered as the final marks.

A candidate who does not submit the field work and/or does not attend the viva-voce examinations 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.