DEGREE OF MASTER OF SCIENCE

M.Sc., GEOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATION AND SYLLABUS

For Affiliated Colleges

Effective from the academic year 2018-2019 onwards

2018
M.Sc., GEOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS

M.Sc Geology programme is being offered under Choice Based Credit System (CBCS). The CBCS enables the students to select varieties of subjects as per her/his interest and requirement. Acquiring knowledge in the related discipline is advantageous to the students. The CBCS programme is framed in such a way that to impart more knowledge in the field of Earth Science.

Condition for Admission
A candidate who has passed B.Sc degree in Applied Geology/ Geology of this university or an examination of any other university accepted by the Syndicate as equivalent there to shall be permitted to appear and qualify for the M.Sc Geology (CBCS) Degree examinations of this university after a course of two academic years.

Core courses
Core courses are compulsory basic subjects in the programme offered by the department. Each core course carries 4 credits. Core courses offered by one department will not be treated as elective by other. Core courses include theory, practical, project work, field training and industrial visits. Students can be permitted to carry out project works at reputed institutions and industries.

Elective courses
Elective courses (disciplinary) are offered by the parent department. Each elective course carries 3 credits.

Extra Disciplinary Elective Subject
Extra Disciplinary Elective Subject courses are aimed at bridging the gap in the curricula and to learn advancement in branch disciplines. Each elective disciplinary elective subject course carries 3 credits.

Compulsory Course
A course on Human rights is compulsory in the II semester.

Semester
An academic year consists of two semesters. The Normal semester periods are
- Odd Semester: July to November
- Even Semester: December to April
Each semester has 18 (eighteen) teaching weeks with working hours spread over 5 days a week.

Credits
The term credit is used to describe the quantum of syllabus for various programmes in terms of hours of study. It indicates differential weightage given according to the contents and duration of the courses in the curriculum design. The minimum credit requirement for a two-year Master’s programme shall be 90.

Course weightage
A course carrying one credit for lectures will have instruction of one period per week during the semester. If four hours of lecture are necessary in each week for that course, then 4 credits will be the weightage. Thus, normally in each of the courses, credits will be assigned on the basis of the lectures/ tutorials/ laboratory work and other forms of learning in a 18-week schedule.

Evaluation

Evaluation will be done on a continuous basis during the course work through class test and midterm exams. Evaluation may be done by objective type questions, short answers, essays or a combination of these, but the end semester examination is a written examination.

Field visits / Mine training/ Internship training

1. Geological mapping: Two weeks field geological mapping in between I\textsuperscript{st} and II\textsuperscript{nd} semester. Students should submit report along with neat sketches.

2. Mine Training: 15 days mine training in selected mine-sites in between 2\textsuperscript{nd} and 3\textsuperscript{rd} semester. Students should submit mine training in the form of a report.

3. Geological Tour: Ten to fifteen days, geological tour of selected locations in between 2\textsuperscript{nd} and 3\textsuperscript{rd} semester. Based on tour, students have to submit a report.

4. Students should undergo internship training in the public and private sectors and submit their report for evaluation at the end of the semester Examination.
## Syllabus for M.Sc., Geology
### Curriculam and Scheme of Examinations

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE</th>
<th>SUBJECT CODE</th>
<th>TITLE OF THE PAPERS</th>
<th>CREDIT</th>
<th>Ins. Hrs/Week</th>
<th>MARKS</th>
</tr>
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<tr>
<td></td>
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<td>EXT. EXAM</td>
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<tr>
<td>1.</td>
<td>CORE I</td>
<td>18GEOC1</td>
<td>GEOMORPHOLOGY AND GEODYNAMICS</td>
<td>4</td>
<td>5</td>
<td>25</td>
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<tr>
<td>2.</td>
<td>CORE II</td>
<td>18GEOC2</td>
<td>PALAEONTOLOGY</td>
<td>4</td>
<td>5</td>
<td>25</td>
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<tr>
<td>3.</td>
<td>CORE III</td>
<td>18GEOC3</td>
<td>ADVANCED CRYSTALLOGRAPHY AND OPTICAL MINERALOGY</td>
<td>4</td>
<td>5</td>
<td>25</td>
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<tr>
<td>4.</td>
<td>CORE PRACTICAL I</td>
<td>18GEOP1</td>
<td>CRYSTALLOGRAPHY, MINERALOGY AND FIELD WORK, PRACTICAL I</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>CORE PRACTICAL II</td>
<td>18GEOP2</td>
<td>STRUCTURAL GEOLOGY, REMOTE SENSING AND PALEONTOLOGY PRACTICAL II</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>MAJOR ELECTIVE I</td>
<td>18GEOE1</td>
<td>REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)</td>
<td>3</td>
<td>3</td>
<td>25</td>
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<td>28</td>
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**SEMESTER II**

|      | CORE IV | 18GEOC4 | MINERALOGY | 4 | 4 | 25 | 75 | 100 |
|      | CORE V  | 18GEOC5 | STRUCTURAL GEOLOGY | 4 | 4 | 25 | 75 | 100 |
|      | CORE VI | 18GEOC6 | STRATIGRAPHY | 4 | 4 | 25 | 75 | 100 |
| 4.   | CORE PRACTICAL I | 18GEOP1 | CRYSTALLOGRAPHY, MINERALOGY AND FIELD WORK, PRACTICAL I* | 4 | 5 | 40 | 60 | 100 |
| 5.   | CORE PRACTICAL II | 18GEOP2 | STRUCTURAL GEOLOGY, REMOTE SENSING AND PALEONTOLOGY PRACTICAL II* | 4 | 5 | 40 | 60 | 100 |
| 6.   | MAJOR ELECTIVE II | 18GEOE2 | FUEL GEOLOGY | 3 | 4 | 25 | 75 | 100 |
| 7.   | EDES I   | 18GEOE1 | NATURAL HAZARDS MITIGATION AND MANAGEMENT | 3 | 2 | 25 | 75 | 100 |
| 8.   | COMPULSORY | 18PHR01 | HUMAN RIGHTS - DUTIES | 3 | 2 | 25 | 75 | 100 |
|      |          |          |                     |        | 15 | 29 | 125 | 570 | 800 |

**SEMESTER III**

|      | CORE VII | 18GEOC7 | IGNEOUS PETROLOGY | 4 | 4 | 25 | 75 | 100 |
|      | CORE VIII| 18GEOC8 | SEDIMENTARY AND METAMORPHIC PETROLOGY | 4 | 4 | 25 | 75 | 100 |
| 4.   | CORE PRACTICAL III | 18GEOP3 | PETROLOGY AND FIELD WORK PRACTICAL III* | 4 |     |     |     |
| 5.   | MAJOR ELECTIVE III | 18GEOE3 | HYDROGEOLOGY | 3 | 4 | 25 | 75 | 100 |
| 6.   | MAJOR ELECTIVE IV | 18GEOE4 | ENVIRONMENTAL GEOLOGY | 3 | 4 | 25 | 75 | 100 |
| 7.   | EDES II  | 18GEOE2 | MARINE GEOLOGY AND QUATERNARY GEOLOGY | 3 | 3 | 25 | 75 | 100 |
| 8.   | INTERNSHIP* | 18GEOIS | INTERNSHIP TRAINING | 2 |     |     | 100 |
|      |          |          |                     |        | 15 | 19 | 125 | 475 | 600 |

**SEMESTER IV**

|      | CORE IX  | 18GEOC9 | ECONOMIC GEOLOGY AND MINERAL ECONOMICS | 4 | 5 | 25 | 75 | 100 |
|      | CORE X   | 18GEOC10 | APPLIED GEOLOGY | 4 | 5 | 25 | 75 | 100 |
| 4.   | CORE PRACTICAL III | 18GEOP3 | PETROLOGY AND FIELD WORK PRACTICAL III* | 4 | 6 | 40 | 60 | 100 |
| 5.   | MAJOR ELECTIVE V | 18GEOE5 | GEOPHYSICS, GEOCHEMISTRY AND GEochRONOLOGY | 3 | 4 | 25 | 75 | 100 |
| 6.   | CORE PROJECT | 18GEOPV | PROJECT & VIVA VOCE | 8 | 4 | 50 | 150 | 200 |
|      |          |          |                     |        | 27 | 30 | 205 | 495 | 700 |

**TOTAL**

|      |          |          |                     |        | 90 | 660 | 1840 | 2500 |

Note: *Practical examination will be held at the even semesters
Allotments of Credits

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<tr>
<th>Course</th>
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<td>Core Course</td>
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<td>Elective Course</td>
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<td>EDES</td>
<td>06</td>
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<td>Internship</td>
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</tr>
<tr>
<td>Human Rights</td>
<td>03</td>
</tr>
<tr>
<td>Project</td>
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Allotments of Papers

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<td>Core Practical’s</td>
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<td>Elective Papers</td>
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<tr>
<td>EDES</td>
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<td>Human Rights</td>
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<td>Project</td>
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Distribution of Marks

<table>
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<tr>
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<th>Credits</th>
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<tr>
<td>University Exam</td>
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<tr>
<td>Internal</td>
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Distribution of Internal Assessment mark

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<th>Test</th>
<th>10 marks</th>
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<td>Attendance</td>
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<tr>
<td>Assignment</td>
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<td>Seminar</td>
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<td><strong>Total</strong></td>
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Passing Minimum: Internal Assessment: 50% - 12 marks
Passing Minimum: External Assessment: 50% - 38 marks
Total Passing Minimum: - 50 marks

Practical's

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<tr>
<th>Theory</th>
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<tr>
<td>University Exam</td>
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Calculation of Internal Assessment mark

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<tr>
<td>Number</td>
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<tr>
<td>Practical Test</td>
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<tr>
<td>Geological Field work, Sample</td>
<td>15 marks</td>
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<td><strong>Total</strong></td>
<td>40 marks</td>
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Passing Minimum: Internal Assessment: 50% - 20 marks
Passing Minimum: External Assessment: 50% - 30 marks
Total Passing Minimum: - 50 marks

Everything should be supported by proper record separate passing minimum is necessary for Internal and External
Question paper pattern

Theory

Time: 3 Hours
Max. marks : 75

Part - A : 5x5 = 25
(Answer all questions)
(one question from each unit with either or type)

Part - B : 5x10 = 50
(Answer all questions)
(one question from each unit with either or type)

Practical

Distribution of marks for practical

<table>
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<tr>
<th>Experiment/ Exercise</th>
<th>55 marks</th>
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<td>Duration</td>
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Project

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<td>200 marks</td>
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SEMESTER- I  
CORE COURSE - I  
SUBJECT CODE: 18GEOC1  

GEOMORPHOLOGY AND GEODYNAMICS

Unit I
Scope and application of Geomorphology – Geomorphic processes and their impact on various land forms – coastline, glacial, aeolian and fluvial and karst topography. Weathering - Erosion transportation, weathering products and soil profile and types.

Unit II
Geomorphology of Indian and Sub continents- Role of geomorphology in mineral, oil and groundwater exploration - Recent changes in Indian river courses and causes. Evolution of shorelines.

Unit III
Oceanic and continental features – Mid oceanic ridges, Gravity and magnetic anomalies at mid oceanic ridge- Trenches, Island Arcs - Eustatic changes and their causes, Ice ages - Concepts of Isostasy – views of Airy, Pratt, Hayford and Bowie and Arthur Holmes.

Unit IV
Earth – Brief review of recent theories about origin of solar system. -Interior of the Earth derived from seismotectonics – Gravitational field of earth Earthquake mechanism – tsunami – Geomagnetism and Palaeomagnetism - Meteorites and other terrestrial materials.

Unit V
Geosynclines – Types and origin. Recent theories about continental drift and seismicity and plate movement – Geodynamics of the Indian Plate – Volcanism and Orogeny and epiorogeny –.Sub marine canyons and fans - Rift valleys and Ramp valleys.
<table>
<thead>
<tr>
<th>Books for Reference</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Introduction to Geophysics</td>
<td>Howel, B.F</td>
</tr>
</tbody>
</table>
CORE COURSE – II

SUBJECT CODE: 18GEOC2

PALAEONTOLOGY

Unit I
Evolution

Unit II
Modern synthetic theory of Evolution, Mutation, Variation, Heredity, Isolation, Imperfections in Palaeontological Record. Brief account of Microevolution, Macroevolution and Megaevolution. Imperfections in Palaeontological record--The Pre- Cambrian fossils- Biodiversity and mass extinction events.

Unit III
Invertebrates
The classification, evolutionary trends and stratigraphic importance of Trilobites, Graptolites, Ammonites and Echinoidea. Uses of species and genera of echinodermata in biostratigraphic correlation.

Unit IV
Vertebrates and Palaeobotany
Evolution of Equidae, Probocidians and Man - Siwalik mammals and Gondwana flora - Brief account of Palynology- Statistical application in paleontology.

Unit V
Micropalaeontology
Field and Laboratory Techniques of Micropaleontology, Morphology of Ostracoda and foraminifera. Evolutionary trends of Foraminifera, Uses of species and genera of Foraminifera in biostratigraphic correlation - Uses of Microfossils.
### Books for Reference

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Author(s) and Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Organic evolution</td>
<td>Arumugam (1989), Sara Publication, Kanyakumari</td>
</tr>
<tr>
<td>8.</td>
<td>Principles of Invertebrate Palaeontology</td>
<td>Sherock, R.R &amp; Twenohofel, W.H (1953), New York</td>
</tr>
</tbody>
</table>
ADVANCED CRYSTALLOGRAPHY AND OPTICAL MINERALOGY

Unit I


Unit II

Calculation of crystal elements making use of Tangent relation, Anharmonic ratio, Napier’s theorem and equation of the normal, 14 Bravais space lattices and derivation of 230 space group, X-ray powder method, Bragg’s Law- and determination of cell edges and volumes.

Unit III

Isotropic crystal: optical properties of isotropic and anisotropic crystals – RI, Double refraction, Birefringence, sign of elongation, interference figure, 2V, pleochroic scheme and Determination of fast and slow Vibration directions-accessory plates- Uniaxial crystals- Uniaxial indicatrix- Examination of Uniaxial crystals under polarized light-Uniaxial interference figures - positive and negative Uniaxial crystals – Dichroism – determination of refractive indices of Uniaxial crystals.

Unit IV

The Fresnel’s ellipsoid - Fletcher’s indicatrix - Primary and secondary optic axes, Interior and exterior conical refraction, optic axial angle; Biaxial crystals in polarized light, Biaxial interference figure - positive and negative biaxial crystals; Dispersion in biaxial crystals - determination of refractive indices of Biaxial crystals.

Unit V

Optical anomalies – Outlines of U-stage methods of determination of optic axial angle, Anorthite content and twin laws of plagioclase feldspars, and orientation of cleavages and twin planes.
<table>
<thead>
<tr>
<th>Books for Reference</th>
<th>Authors/Editors</th>
<th>Publication Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Axes Universal Stage</td>
<td>Naidu P.R.J (1958) Mineralological Society of India, Madras.</td>
<td></td>
</tr>
</tbody>
</table>
REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM  
(GIS)

Unit I

Unit II
Stereoscopy – stereoscopic vision, Pocket lens and mirror stereoscope – measurement of height and slope – Aerial mosaics; definition – difference between map and mosaic – different kinds of mosaics and their compilation. Interpretation of aerial photographs as applied to Geology.

Unit III

Unit IV

Unit V
Geographical Information System: Definition - Components and Scope of GIS - Spatial and Attribute Data - Data analysis – Integration and overlay analysis. Applications of GIS in various geological studies - Decision support system - Different GIS Software packages.
<table>
<thead>
<tr>
<th>Books for Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.</strong> Remote Sensing and Image Interpretation</td>
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</tbody>
</table>
SEMESTER II

CORE COURSE- IV

MINERALOGY

SUBJECT CODE: 18GEOC4

Unit I

Classification of minerals- Structural and chemical principles of Minerals-, chemical bonds, ionic radii-, coordination numbers and polyhedran- Silicate structures – Isomorphism – Polymorphism – structural, physical, optical and chemical properties of the following groups and their geneses: - quartz,

Unit II

Structural, physical, optical, chemical and genetic characteristics of the feldspar, feldspathoids, pyroxene and amphiboles.

Unit III

Structural, physical, optical, chemical and genetic characteristics of the following groups: - olivine, mica, chlorite, epidote and scapolite.

Unit IV

Structural, physical, optical, chemical and genetic characteristics of the following Group.: - zeolite - clay minerals – garnet.

Unit V

Structural, physical, optical, chemical and genetic characteristics of the following minerals: - apatite, fluorite, tourmaline, beryl, topaz, sphene, spinel, cordierite, staurolite, andalusite, sillimanite, kyanite and wollastonite.

Books for Reference

1. An Introduction to Rock Forming Minerals
2. Dana’s Manual of Mineralogy
   Hurlbut.C.C, (1961), New York
3. Optical Mineralogy
4. Mineralogy
5. Principles of Geochemistry
STRUCTURAL GEOLOGY

Unit I


Unit II


Unit III


Unit IV


Unit V

**Books for Reference**

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<th>Author(s)</th>
<th>Publisher</th>
<th>Year</th>
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CORE COURSE- VI  
SUBJECT CODE: 18GEOC6

STRATIGRAPHY

Unit I

Principles of Stratigraphy


Indian Stratigraphy

Unit II

Stratigraphy and mineral riches of Dharwar Supergroup of Karnataka, Cuddapah Supergroup of Andhra Pradesh and Vindhyan system.

Unit III

Age of Saline series. Permo-Carboniferous of Salt range and Spiti, Climate, Sedimentation, Stratigraphy and Economic importance of Gondwana Supergroup.

Unit IV


Unit V

Age of Deccan trap – Lameta beds - Changes at the end of Cretaceous and at the beginning of Tertiary - Siwalik system and Karewa series.

Books for Reference

1. The Geology of India and Burma  
   Krishnan, M.S (1968) C.B.S Publication & Distribution

2. Geology of India Fundamentals of Historical Geology and Stratigraphy  

3. Geology of India.  
FUEL GEOLOGY

Unit I
Coal Geology

Unit II

Unit III
Petroleum Geology
Petroleum – its composition and Properties; Origin (formation of Source rock Kerogen, organic maturation and thermal cracking of kerogen) and migration of petroleum. Reservoir rocks – porosity and permeability. Reservoir traps – structural, stratigraphic and combination traps. Oil field fluids – water, oil and gas.

Unit IV
Methods of prospecting for oil and gas (geological modeling); Elementary knowledge of drilling and logging procedures - Oil shale - An outline of oil belts of the world. Onshore and offshore petroliferous basins of India. Oil policy of India. Gas Hydrates: Exposure to gas hydrates and future prospective.

Unit V
Atomic Energy
Books for Reference


11. VBoyle, R.W., 1982: Geochemical prospecting for Thorium and Uranium deposits, Elsevier
NATURAL HAZARDS, MITIGATION AND MANAGEMENT

Unit I


Unit II


Unit III


Unit IV

Landslides- types -slow flowage, rapid flowage, sliding and subsidence – causes and mechanism - Vulnerable zones in India - mitigation measures and management. Deforestation and land degradation-Cyclone- Definition -causes - vulnerable zones in India-mitigation measures and management.

Unit V


Books for Reference

3. Engineering and general geology Parbin Singh (2003) S.K.Kataria and sons Delhi India
4. Genaral Geology V.Radhakrishnan (1996) V.V.P.Publishers, Tuticorin,India
Unit I

Stereographic and Gnomonic projections of natural crystals of normal classes; Symmetry projection of 32 classes; calculation of crystal elements to test the knowledge of the application of tangent relation, anharmonic ratio, Napier’s theorem and equation of the Normal.

Unit II

Microscopic study of the optical properties of important rock forming minerals; Megascopic study of important minerals.

Unit III

Determination of dichroic and pleochroic schemes; Determination of extinction angle; Optic orientation, Identification of pinacoidal sections of amphiboles and pyroxenes; optic orientation.Determination of the sign of elongation; Determination of the optic sign of uniaxial and biaxial minerals; determination of birefringence; Determination of the optic axial angle by Mallard’s method.

Unit IV

Determination of the following by U – stage methods - Optic axial angle; Anorthite content and twin laws in plagioclase feldspars and optic orientation in other minerals.

Unit V

Mineral calculations for the following group of minerals – feldspars, pyroxenes, amphiboles, olivine, micas and garnets.

FIELD WORK I

In partial fulfilment of the M.Sc Geology degree course, the students should be taken to areas of geological importance for a period of 8 to 10 days, for learning geological mapping. They should present the collected specimens along with their thin sections and submit a report on the field training at the time of the Main Practical Examination.
STRUCTURAL GEOLOGY, REMOTE SENSING AND PALAEONTOLOGY

Unit I
Study and interpretation of geological maps showing fold, fault, unconformities and igneous intrusions.

Unit II
Solving structural Geology problems – relating to dip of bed and width of outcrop; relating to fold and faults – preparation of pi and diagrams& their interpretations.

Unit III
Remote sensing –preparation of geomorphological, geological and structural maps from aerial photographs; interpretation of satellite imageries for geological features.

Unit IV

Study of Fossiliferous rocks – shell limestone, crinoidal limestone, calc-tufa. Reconstruction of fossils, Evolutionary trends observed in the fossils of the following groups; Trilobites, Ammonoidea and Graptozoaa.

Unit V

Gastropods – Turritella, Turbo, Trochus, Cerithium, Natica, Conus, Fusus, Physa, Voluta, Murex, Bellerophon, Helix, Cyprea, Euomphalus.

Cephalopods – Nautilus, Ceratite, Orthoceras, Turrilites, Goniatite, Acanthoceras, Baculites, Belemnites.

Arthropods
Trilobites; Paradoxides, Phacops, Calymene, Olenus, Olenellus.
Corals – Halysites, Favorites, Thecosmelia, Calceola, Zaphrentis, Lithostrotion.
Echinoderma – Cidaris, Holaster, Hemiaster, Micraster, Encrinus, Marsupites, Stigmatopygus.
Brachiopods – Atrypa, Terebratula, Athyris, Orthis, Spirifer, Rhynconella, Pentamerous, Productus.
Graptolites – Monograptus, Diplograptus, didymograptus, Tetragraptus.
Plant fossil – Ptilophyllum, glossopteris, Calamites, Elatocladus, Lepridodendron, Sigillardia, Stigmaria, Otozomites, Gondwanadium.

Visit to a nearby geological organizations.
SEMESTER III
CORE COURSE - VII
SUBJECT CODE: 18GEOC7

IGNEOUS PETROLOGY

Unit I


Unit II

Concept of experimental petrology. Study of phase rule as applied to silicate systems; binary systems, (a) Forsterite – Fayalite, (b) Leucite – Silica and (c) Nepheline – Silica. Study of ternary systems (a) Anorthite – Forsterite – Silica (b) Forsterite – Diopside – Silica and (c) Nepheline – Kaliophyllite – Silica system. Bowen’s reaction principle.

Unit III

Study of the crystallization of the basaltic magma; and granitic magma; role of fugitive constituents in the magma; diversity of igneous rocks – Differentiation, assimilation; Magma mixing. Variation diagrams.

Unit IV

Petrography, classification and origin of important rocks such as alkaline rocks, ultramafic rock association, anorthosites, kimberlites carbonatites, Ophiolites, lamprophyres, Pegmatites and their volcanic equivalents.

Unit V

Magmas their generation in crust and mantle, their emplacement and their relation to plate tectonics Petrogenetic provinces: Continental areas: Volcanic-Flood basalts-Tholeiites (Deccan Trap, Columbia River basalts); Layered gabbroic intrusions: The Bushveld complex, Skaergaard intrusion, Still water complex. Plutonic: Carbonatites and alkaline rock complexes of India; Oceanic Rift valleys: MORB- Tholeiites – Ophiolites.
Books for Reference

2. The origin of Igneous Rocks Bowen, N.L (1928), Princeton.
SEDIMENTARY AND METAMORPHIC PETROLOGY

Sedimentary Petrology

Unit I
Texture of Sediments and Sedimentary Rocks – size-concept of size, shape and roundness, porosity and permeability. Textures of non-clasticsediments – Sedimentary Structures and their importance - The mechanical, chemical and biological structures of sedimentary rocks – Classification of Sedimentary Rocks-Clastics and carbonate rocks

Unit II

Unit III
Petrology of Non-clastic Rocks- Limestones and Dolomites- Phosphatic sediments and Phosphorites- Volcanic clastic Sediments-Environmental analysis: Parameters and classification – Sedimentation and tectonics-Modern classification of sedimentary basin (plate tectonics context) Indian sedimentary basin and classification.

Metamorphic Petrology
Chemical principle of metamorphism, phase rule, Brief study of metamorphic zones, grades and facies.

Unit IV

Unit V
Metamorphic diffusion and differentiation –paired metamorphic belts- Metasomatism – petrography and petrogenesis of migmatites, amphibolites, charnockites and eclogites.
### Books for Reference

1. **Sedimentary Rocks**

2. **Manual of Sedimentary Petrography**

3. **Sedimentary Petrography**

4. **Petrography**

5. **Introduction to Sedimentology**

6. **Metamorphism**

7. **Metamorphism and Metamorphic belts**

8. **Metamorphic Petrology**

9. **Igneous and Metamorphic Petrology**

10. **Petrology of Metamorphic Rocks**

11. **Petrogenesis of Metamorphic rocks**

12. **Petrologic Phase Equilibria**
    - Ernst, W.G., (1976), W.H. Freeman & Co, USA.

13. **Metamorphic Petrology**

### MAJOR ELECTIVE- III

**SUBJECT CODE: 18GEOE3**
HYDROGEOLOGY

Unit I
Hydrologic cycle, subsurface movement and vertical distribution of ground water. Classification of aquifer, concepts of drainage and groundwater basin. Rainfall and its analysis; Runoff assessment.

Unit II
Theory of ground water flow, Darcy’s law, its Validity and application, determination of permeability in the laboratory and in the field. Well hydraulics, data analysis and interpretation.

Unit III

Unit IV
Groundwater provinces of India. Investigation of groundwater by surface and subsurface methods- Field procedure Inverse slope and Curve matching methods. Types of wells, drilling methods, construction and design, development and maintenance of wells

Unit V
Water quality criteria for different uses, Graphical presentation of water quality data – bar, pie and Piper’s trilinear diagrams. Groundwater pollution. Artificial recharge and rainwater harvesting

Books for Reference

MAJOR ELECTIVE- IV  
SUBJECT CODE: 18GEOE4

ENVIRONMENTAL GEOLOGY

Unit I


Unit II


Unit III

Air Pollution, sources of pollution, pollution due to dust and waste disposal. National and International standards; Noise levels- national standards, mining machinery, ill effects.Air sampling techniques – Respirable dust samplers, high volume air samplers, personal sampling pumps, weather monitoring equipments, automatic recorders. Introduction to Environmental Magnetism.

Unit IV


Unit V

### Books for Reference

1. **Environmental Geology**

2. **Environmental Geosciences: Interaction between Natural System and Man**

3. **Geology, Environment and Society**

4. **A Text book in Environmental Science**

5. **Advances in Environmental Science (Vol I & II)**

6. **Man’s Impact on Environment**

7. **Man’s Role in Changing Face of the Earth**
MARINE GEOLOGY AND QUATERNARY GEOLOGY

Unit I
Morphologic and tectonic domains of the ocean floor, structure composition and mechanism of the formation of Ocean crust, hydrothermal vents: Ocean margins and their significance -Ocean circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino.

Unit II
Indian ocean Dipole Thermohaline circulation oceanic surveyor belt.Formation of bottom waters; major water masses of the world’s oceans. Oceanic sediments: Factors controlling the deposition and distribution of ocean sediments, diagenetic changes on oxic and anoxic environments.

Unit III
Tectonic evolution of the ocean basins.Mineral resources.Palaeoceanography – Approaches to Palaeo oceanographic reconstructions; various proxy indicators for Palaeo oceanographic interpretation.

Unit IV
Sea level processes and sea level changes. Methods of palaeo Sea Surface temperature Quantifications. Reconstruction of monsoon variability by using marine proxy records opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic.

Unit V
Definition of Quaternary. Quaternary Stratigraphy – Oxygen isotope stratigraphy, biostratigraphy and magneto stratigraphy. Quaternary climates – glacial-interglacial cycles, eustatic changes, proxy indicators of palaeo environmental/paleo climatic changes, - land, ocean and cryosphere (ice core studies). Responses of geomorphic systems to climate, sea level.

Books for Reference
SEMESTER- IV

CORE COURSE - IX

SUBJECT CODE: 18GEOC9

ECONOMIC GEOLOGY AND MINERAL ECONOMICS

Unit I

Classification of ore deposits, Controls of ore localization, Metallogenic epochs and provinces, Micro textures of ore, Paragenesis and Zoning. Geologic thermometry - Wall rock alterations.

Unit II

Study of the following metallic and non-metallic minerals with reference to their mineralogy, mode of occurrence, distribution in India and origin: Iron, Copper, gold, manganese,

Unit III

Study of the following metallic and non-metallic minerals with reference to their mineralogy, mode of occurrence, distribution in India and origin: Mica, lead and zinc, placer deposits, rare earth minerals.

Unit IV

Minerals used in industry: glass, fertilizers, paint, ceramics, cement, abrasives, refractory and gemstones, their mineralogy, mode of occurrence and distribution in India and origin.

Unit V

Books for Reference

1. Economic Mineral deposits
2. Petroleum Geology
3. Introduction to Economic Mineral
4. Ore Deposits
5. India’s Mineral Resources
6. Mineral of India
7. Mineral Deposits
8. Mineral Economics
APPLIED GEOLOGY

Unit I

Unit II

Unit III

Unit IV
Geological, Geochemical and Geophysical exploration methods for oil and gas-techniques - Oil drilling methods: rotary drills, cable tool drill, diamond drill, direction of drill, off shore drilling technology, drilling fluids – mud, polymers and their properties.

Unit V
Books for Reference

1. Mineral Economics

2. Courses in mining Geology

3. Mining Geology

4. India’s Mineral Wealth

5. Ore deposits of India

6. Text Book of Mining Geology

7. Petroleum Geology

8. Principles of Engineering Geology

9. Geotechniques
   F.G.Bell, (2005), B.S. Publications, A.P.
MAJOR ELECTIVE- V  
SUBJECT CODE: 18GEOE5

GEOPHYSICS, GEOCHEMISTRY AND GEOCHRONOLOGY

Unit I

Unit II

Unit III

Unit IV
Geochemistry
Principles of evolution of hydrosphere, biosphere and atmosphere. Geochemical classification and distribution of elements in the earth-Cosmic abundance of elements-Geochemical cycle-Primary dispersion and Secondary dispersion-Geochemical Prospecting - Background value, Threshold value, Path finder element - Geochemical anomaly-sampling, Geobotonical Indicators.

Unit V
Geochronology
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<th>Books for Reference</th>
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<td>3. Geophysics</td>
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PETROLOGY AND FIELD WORK II

Unit I

Study of orbicular, graphic, Rapakivi structures. Megascopic study of the following igneous rock types: granites, syenites, diorites, gabbros, norite, anorthosite, dunite, peridotite, pyroxenite, nepheline syenites, theralite, carbonatite, pegmatite, aplite, dolerite, rhyolite, trachyte, andesite, basalt, felsite, shonkinite, obsidian, pitchstone, pumice, scoria, vitrophyre, porphyritic varieties of granite, syenite, dolerite, granites of Closepet, Trichengodu, Sankari, Chamundi; syenites of Sivanmalai, Pikkili and Deccan Basalts.

Unit II

Megascopic study of the following sedimentary and metamorphic rock types: laterite, breccias, conglomerates, grit, arkose, clay, sandstones, shales, limestones, chert, flint, coal and its varieties. Shell limestone of Trichy. Cuddapah limestone, Satyavedu sandstones, Srisperambudur shales, Neyveli lignite, slates, schists, phyllites, gneisses, amphibolite, charnockite, granulites, hornfels, eclogite, quartzites, marbles, quartz magnetite rock, leptynite, Khondalite, Peninsular gneiss, cordierite, sillimanite gneiss of Ganguvarpatti, Pallavaram charnockite, Calc silicate rocks of Madukkarai, Nagari quartzite.

Unit III

Microscopic study of the rocks: Grain determination, Modal analysis, Petrographic study of the following igneous rock types: granites, syenites, diorites, gabbros, Norite, anorthosite, dunite, peridotite, pyroxenite, nepheline syenites, theralite, carbonatite, pegmatite, aplite, dolerite, rhyolite, trachyte, andesite, basalts, phonolite, felsite, shonkinite, obsidian, pitchstone, scoria, Porphyritic varieties of granite, syenite and dolerite.

Unit IV

Microscopic study of the following Sedimentary and Metamorphic rock types: laterite, breccia, conglomerates, grit, arkose, greywacke, clay, sandstones, shales, limestones, chert, flint.
slate, schist, phyllite, gneisses, amphibolite, charnockite, granulites, hornfels, eclogite, quartzite, marble, leptynite.
UNIT V


FIELD WORK II

In partial fulfillment of the M.Sc Geology degree course, the students should be taken to areas of geological importance for a period of 8 to 10 days, for rocks and mineral collections. They should present the collected specimens along with their thin sections and submit a report on the field work at the time of the Main Practical Examination.
ECONOMIC GEOLOGY AND APPLIED GEOLOGY

Unit I
Megascopic study of the following ore minerals: bauxite, chromite, franklinite, limonite, molybdenite, stibnite, willemite, zincite and zircon.

Ore minerals of copper, iron, lead and zinc, manganese, nickel, silver, tin and Radioactive minerals.

Unit II
Megascopic study of the following industrial minerals: asbestos, barite, graphite, gypsum, micas, ochres. Minerals used in the refractory industry - Minerals used as abrasives, Minerals used in cement, ceramic, fertilizer, glass, paint and pigment industries: Building Stones.

Unit III
Study of important ore textures. Estimation of ores: ferrous and ferric iron, copper, lead and calcium.

Unit IV
Sampling of ores and evaluation problems: Sampling at regular intervals.

Unit V

Visit to a nearby geological organization for a day or two.