Eligibility

Candidates for admission to the First year of the Five year Integrated M.Sc., Applied Geology degree programme shall be required to have passed in higher Secondary Course examinations (HSC) or equivalent thereto under academic stream in any science group.

Master Programme

A Master’s programme consists of a set of Core courses and Common courses on languages, Computer application, Civics, Health & Environment and Soft skill.

Core courses are basic courses required for each programme. The number and distribution of credits for core courses will be decided by the respective faculties.

Common courses suggested by the respective departments may be distributed in the first four semesters.

A course is divided into five units to enable the students to achieve modular and progressive learning.

Semesters

An Academic year is divided into two semesters, Odd semester and Even semester. The normal semester periods are:

Odd semester: July to November (90 working days)

Even semester: December to April (90 working days)

Credit

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 Five year Integrated Master’s Programme shall be 225.
The core courses shall carry 155 credits, Common courses shall carry 10 credits, Allied courses shall carry 20 credits, Language courses shall carry 24 credits and the optional courses shall carry 16 credits.

Courses

A course carrying one credit for lectures, will have instruction of one hour per week during the semester, if four hours of lecture is 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 lecture tutorials/laboratory work and other form of learning in a 15 week schedule:

i) One credit for each lecture hour per week.
ii) One credit for every two or three hours of laboratory or practical work per week as per the requirement of department concerned.

Grading System

The term Grading System indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Duration

The duration for completion of a Five year Integrated Master’s Programme in any subject is Ten semesters.

Structure and Programme

The Five year Integrated Master’s Programme will consist of:

i) Core courses and Common courses which are compulsory for all students.
ii) Optional courses which students can choose amongst the courses offered by the Departments of Science faculty as well as by the Departments of other faculties. (Arts, Education and Indian Language)

Attendance

Every teaching faculty handling a course shall be responsible for the maintenance of attendance register for candidates who have registered for the course.

Each student should earn 80% attendance in the courses of the particular semester failing which he or she will not be permitted to sit for the End-semester examination.
However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a condonation fee and such exemptions should not under any circumstance be granted for attendance below 70%.

**Examinations**

The internal assessment for each theory course carries 25% marks and practical course 40% of marks which is based on two internal assessment tests with assessment tools such as seminar and assignment. The pattern of question paper will be decided by the respective faculty. **The tests are compulsory.**

For internal assessment evaluation, the break-up marks shall be as follows:

<table>
<thead>
<tr>
<th>THEORY</th>
<th>MARKS</th>
<th>PRACTICAL</th>
<th>MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-I</td>
<td>10</td>
<td>Test-I</td>
<td>15</td>
</tr>
<tr>
<td>Test-II</td>
<td>10</td>
<td>Test-II</td>
<td>15</td>
</tr>
<tr>
<td>Assignment</td>
<td>5</td>
<td>Record</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

There will be one End Semester Examination (75% marks) of 3 hours duration for each Theory course and an End semester examination (60%) to each Practical courses. The pattern of question paper will be decided by the respective faculty.

**Evaluation**

The performance of a student in each course is evaluated in terms of Percentage of Marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance in Core, Allied and Optional courses will be marked by (CGPA).

**Marks and Grading**

The student cannot repeat the internal assessment test I and internal assessment test II. However, if for any compulsive reason, the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A student has to secure 50% minimum in the End Semester Examination.

The student who has not secured minimum of 50% of marks (Internal assessment mark plus End semester examination) in a course shall be deemed to have failed in that course.
A candidate who has secured a minimum of 50% marks in all the courses prescribed in the programme and earned a minimum of 225 credits will be considered to have passed the Masters Programme.

**Grading**

A ten point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master’s Programme.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Grade Point</th>
<th>Letter Grade</th>
<th>Class</th>
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<tbody>
<tr>
<td>90+</td>
<td>10</td>
<td>S</td>
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</tr>
<tr>
<td>85-89</td>
<td>9.0</td>
<td>D++</td>
<td>Distinction</td>
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<tr>
<td>80-84</td>
<td>8.5</td>
<td>D’</td>
<td>&quot;</td>
</tr>
<tr>
<td>75-79</td>
<td>8.0</td>
<td>D</td>
<td>&quot;</td>
</tr>
<tr>
<td>70-74</td>
<td>7.5</td>
<td>A++</td>
<td>First Class</td>
</tr>
<tr>
<td>65-69</td>
<td>7.0</td>
<td>A’</td>
<td>&quot;</td>
</tr>
<tr>
<td>60-64</td>
<td>6.5</td>
<td>A</td>
<td>&quot;</td>
</tr>
<tr>
<td>55-59</td>
<td>6.0</td>
<td>B</td>
<td>Second Class</td>
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<tr>
<td>50-54</td>
<td>5.5</td>
<td>C</td>
<td>&quot;</td>
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<tr>
<td>49 or Less</td>
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<td>F</td>
<td>Fail</td>
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</table>

Grade cards will be issued to the students, after the declaration of results. The grade card will contain the list of courses registered during the semester, the grades scored and the **Grade Point Average** for the semester.

**GPA** is the sum of the products of the number of credits of courses with the grade point scored in that programme, taken over all the courses for the semester divided by the sum of the number of credits for all courses taken in that semester. **CGPA** is similarly calculated considering the Core, Allied and Optional courses taken from first semester to tenth semester.

The results of the final semester will be withheld until the student obtains passing grade in all the courses of all earlier semesters.

**DEGREE WILL BE AWARDED AS FOLLOWS:**

Those who complete successfully all the TEN – Semester Examinations will be issued both B.Sc., and M.Sc., degree certificates.
(i). For UG Degree

B.Sc., degree will be awarded after the completion of six semesters to the candidate who has passed all the Courses upto six semesters with the following Classifications based on CGPA after successful completion of Ten semesters examinations.

For First class with Distinction the student must earn 135 Credits, passes all the courses in the first attempt and obtain a CGPA of 8.00 or above in Part – III core and Allied courses from first to six semesters.

For the First class the student must earn 135 Credits, Passes all the courses and obtain a CGPA of 6.50 or above in Part – III Core and Allied courses from first to six semesters.

For the Second class the student must earn 135 credits and pass all the courses and obtain a CGPA of 6.0 or above in part-III Core and Allied courses from first to six semesters.

(ii) FOR PG Degree

M.Sc., degree will be awarded after successful completion of all ten semester examinations and Earned 225 credits with the following classification based on CGPA.

For First class with Distinction the student must earn 225 credits Passes all the courses in the first attempt and obtain a CGPA of 8.00 or above in Part-III Core, Allied and Optional courses from first to ten Semesters.

For the First class the student must earn 225 credits, Pass all the courses and obtain a CGPA of 6.50 or above in Part-III Core, Allied and Optional courses from first to ten semesters.

RANKING OF CANDIDATES

(i). For UG Degree

The candidates who are Eligible to get the B.Sc degree in first class with distinction will be ranked on the basis of CGPA scored in Part-III Core and Allied courses of study from first semester to sixth semester.

The candidates passing with First class will be ranked next to those with distinction on the basis of CGPA scored in part-III core and Allied courses of study from first semester to sixth semester.

(ii). For PG Degree
The candidates who are Eligible to get the M.Sc degree in **first class with distinction** will be ranked on the basis of CGPA scored in Part-III Core, Allied and Optional courses of study from first semester to tenth semester.

The candidates passing with **First class** will be ranked next to those with distinction on the basis of CGPA scored in Part-III Core, Allied and Optional courses of study from first semester to tenth semester.

Candidates who obtain **First class with distinction** shall be deemed to have passed the examinations provided he / she passes all the courses prescribed for the programme at the **First Appearance**.

**R13. TRANSITORY REGULATIONS**

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three times consecutively after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent programmes, as per the new syllabi, on the recommendations of the Head of the Department concerned.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the programmes of study and the syllabi from time to time.
# M.Sc., GEOLOGY-CBS (INTEGRATED) WITH EXIT OPTION-2014-15

## SCHEME OF EXAMINATIONS

### SEMESTER – I

<table>
<thead>
<tr>
<th>Course code</th>
<th>Theory &amp; Practical</th>
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<th>P</th>
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<tbody>
<tr>
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<td>IENC 12</td>
<td>Language- II English</td>
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<tr>
<td>ICEC 13</td>
<td>Civics, Environmental and Health Sciences</td>
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<td>IGYT 14</td>
<td>Physical &amp; Dynamic Geology</td>
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<tr>
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### SEMESTER – II

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<td>IENC 22</td>
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<td>ICAC 23</td>
<td>Computer Application s-I</td>
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<td>IGYT 24</td>
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<td>IGYA 25</td>
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<td>IGYP 26</td>
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<td>IENC 32</td>
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<tr>
<td>IGYT 33</td>
<td>Crystallography</td>
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<td>IGYT 34</td>
<td>Paleontology</td>
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<td>IGYA 35</td>
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Field visit to various Paleontological significant areas

### SEMESTER – IV

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<td>IENC 42</td>
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<tr>
<td>IGYT 43</td>
<td>Structural Geology</td>
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<td>5</td>
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<tr>
<td>IGYT 44</td>
<td>Mineralogy</td>
<td>5</td>
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<tr>
<td>IGYA 45</td>
<td>Ancillary- II -Physics -II</td>
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<tr>
<td>IGYP 46</td>
<td>Practical - II Structural Geology &amp; Mineralogy</td>
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<td>IGYP 47</td>
<td>Ancillary Practical - II (Physics)</td>
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Field visit to various structural & Mineralogical features

<table>
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<tr>
<th>SEMESTER – V</th>
<th>Course code</th>
<th>Theory &amp; Practical</th>
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<th>P</th>
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<tbody>
<tr>
<td>IGYT 51</td>
<td>Igneous Petrology</td>
<td>5</td>
<td>5</td>
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<tr>
<td>IGYT 52</td>
<td>Stratigraphy &amp; Indian Geology</td>
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<td>IGYT 53</td>
<td>Basics of Remote Sensing, GIS &amp; GPS</td>
<td>5</td>
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<tr>
<td>IGYT 54</td>
<td>Hydrogeology &amp; Environmental Geology</td>
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<td>IGYP 55</td>
<td>Practical – III Igneous Petrology</td>
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<td>IGYP 56</td>
<td>Practical – IV Hydrogeology &amp; Remote Sensing</td>
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<tbody>
<tr>
<td>IGYT 61</td>
<td>Sedimentary &amp; Metamorphic Petrology</td>
<td>4</td>
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<tr>
<td>IGYT 62</td>
<td>Economic Geology and Mineral Economics</td>
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<td>IGYT 63</td>
<td>Geoeexploration</td>
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<td>IGYT 64</td>
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<td>IGYP 66</td>
<td>Practical – VI Economic Geology &amp; Engineering Geology</td>
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<td><strong>Total</strong></td>
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(Grand total = 135)

<table>
<thead>
<tr>
<th>Semester-VII</th>
<th>Course code</th>
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</thead>
<tbody>
<tr>
<td>IGYT 71</td>
<td>Global Tectonics &amp; Petrofabrics</td>
<td>4</td>
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<tr>
<td>IGYT 72</td>
<td>Marine Geology</td>
<td>4</td>
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<tr>
<td>IGYT 73</td>
<td>Coal &amp; Petroleum Geology</td>
<td>4</td>
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<td></td>
<td>Soft Skills</td>
<td>4</td>
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<tr>
<td>IGYP 74</td>
<td>Practical – VII Survey</td>
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<td><strong>Total</strong></td>
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<td>16</td>
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Geological Mapping training - two week’s duration

<table>
<thead>
<tr>
<th>Semester- VIII</th>
<th>Course code</th>
<th>Theory &amp; Practical</th>
<th>L</th>
<th>P</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>IGYT 81</td>
<td>Advanced Crystallography, Mineralogy &amp; Optics</td>
<td>4</td>
<td>4</td>
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<tr>
<td>IGYT 82</td>
<td>Ore Genesis and Industrial Minerals</td>
<td>4</td>
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<tr>
<td>IGYT 83</td>
<td>Mineral Beneficiation</td>
<td>4</td>
<td>4</td>
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<tr>
<td>IGYO 84</td>
<td>Optional – I Field Geology</td>
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<tr>
<td>IGYP 85</td>
<td>Practical –VIII Mineralogy, Crystallography, Mineral Optics &amp; Ore Petrology Geological Mapping</td>
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<td>IGYP 86</td>
<td>Practical –IX. Mineral Dressing</td>
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Industrial/ institutional training –Three/four week’s duration.
### Semester- IX

<table>
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<tr>
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<tbody>
<tr>
<td>IGYT 91</td>
<td>Advanced Igneous &amp; Metamorphic Petrology</td>
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<tr>
<td>IGYT 92</td>
<td>Advanced Stratigraphy, Sedimentology and Micropaleontology</td>
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<td>IGYT 93</td>
<td>Geological &amp; Geophysical Exploration</td>
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<tr>
<td>IGYT 94</td>
<td>Geochemical Exploration &amp; Isotope Geology</td>
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<td>IGYO 95</td>
<td>Optional – II – Geostatistics</td>
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<td>IGYP 96</td>
<td>Practical – X Geoeploration, Geochemistry &amp; Geophysics</td>
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<td></td>
<td>Industrial/Institutional Training Report</td>
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<td>IGYP 97</td>
<td>Practical – XI Petrology, Sedimentology &amp; Micropaleontology</td>
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**Short Field visits to nearby geologically interesting places during week end & holidays**

### Semester-X

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<td>IGYT 101</td>
<td>Advanced Hydrogeology, Remote Sensing &amp; GIS</td>
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<td>IGYT 102</td>
<td>Medical Geology</td>
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<td>IGYO 103</td>
<td>Optional – III (Internal) Atmospheric science and Meteorology</td>
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<td>IGYO 104</td>
<td>Optional– IV (Internal) Geological Instrumentation &amp; Analytical Techniques</td>
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<td>IGYP 105</td>
<td>Practical – XII Hydrogeology, Remote Sensing &amp; GIS</td>
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<td>Field Training Report</td>
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<tr>
<td>IGYP 106</td>
<td>Dissertations and Viva – Voce</td>
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<td>Total</td>
<td>16</td>
<td>8</td>
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**OVERALL TOTAL CREDIRTS = 225 (CORE 115 + 40 =155: OPTIONAL =16: SOFT SKILL= 4 ANCILLARY =20: LANGUAGE= 24: COMPUTER APPLICATION = 3: CIVICS, ENVIRONMENTAL AWARENESS & HEALTH =3).**
SEMESTER – I

ICEC 13 CIVICS, ENVIRONMENTAL AWARENESS & HEALTH SCIENCES

(A) CIVICS

UNIT – I: INTRODUCTION

Unit II: Political System

Books Recommended
- R.C. Agarwal, 2000, Indian Political System, New Delhi, S.Chand & Company.
- James H. Mecrocklin, 1961, Building Citizenship, USA Allyn and Bacon, INC.,

(B) Environmental Sciences

Unit – I: Ecosystems

Unit – II: Environment

References
- Agarwal & Rana. S.V.S. Environment & Natural Resources, Society of Biosciences.
(C) Health Sciences

UNIT – I: Physical Health – Introduction to health – Food, meaning of balanced diet. Sources, Common nutritional deficiencies and prevention. Personal Health – Cleanliness of body. Care of Skin, Nails, Eye, Hair, Oral Health and Clothing. Body posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc.


Communicable Diseases – Symptoms and prevention.

UNIT – II:
2. Environment – Ventilation, Lighting, Simple methods of Worm infestation (round worm, hook worm).

Books for study and reference

IGYT-14 PHYSICAL & DYNAMIC GEOLOGY

UNIT-I: Solar system – outer and inner planets. Earth as a member of the solar system and its relation to other planets – Size and Density of the Earth. Origin of the Earth – Nebular, Planetesimal, Tidal and Dust cloud hypotheses; their merits and demerits.

UNIT-II: Relief features-classification of relief feature into I, II and III orders. Mountains and mountain chains-Classification of mountains-origin of tectonic mountains; contraction theory, continental drift theory. Age of the Earth. Interior of the earth – structure and constituents.

UNIT-IV: Volcanoes – types of volcanic eruption – central vent and fissure types; dormant and extinct volcanoes. Types of volcanic cones; classification of volcanoes based on the nature of volcanic activity; Products of volcanoes – distribution and causes of volcanism.


Books for study and reference

- Miller, 1949, An Introduction to Physical Geology, East West Press Ltd.
- Spencer, E.V, 1962, Basic concepts of physical Geology, Oxford & IBH,New Delhi
- S.M. Mathur, 2000, Elements of Geology, CBS publishers & Distributors
- P.S. Saklani, 2006, Tectonic Geology, Satish serial publishing.

SEMESTER – II

ICAC- 23 COMPUTER APPLICATIONS

UNIT-I: INTRODUCTION TO COMPUTERS:
unit-I: INTRODUCTION TO COMPUTER HARDWARE:


UNIT-II: INTRODUCTION TO COMPUTER SOFTWARE:


UNIT-III: MS WORD:

Managing files in office- text tools- word- editing text- documenting format – styles and templates- tables and columns – mail merge, labels and envelopes Databases: Databases in access – defining and developing tables – creating queries – forms and reports – building a database application

UNIT-IV: SPREADSHEETS:

Excel – Formatting worksheets and restricting data – calculating with formulae and functions – charts and pivot tables. Presentations: Power point- creating and editing slides- adding graphics, multimedia and special effects in slides. Showing the power point presentations.

UNIT-V: INTERNET AND WORLD WIDE WEB:

Introduction- Internet axis- Internet basic- Internet addressing- WWW- Web browsing- Searching the web- ELECTRONIC MAIL: Introduction- Use E-mail?- E-mail-names & addresses- Mailing basics- E mail-advantages & disadvantages- Mailing lists- Newsgroups- ELECTRONIC COMMERCE: Introduction- Business-to- business E-commerce- The virtual
shop- MULTIMEDIA TOOLS: Introduction- Paint and draw applications- Graphic effects and techniques- Sound and music- Video- Multimedia authoring tools.


Books for study and reference

- Margaret Levine Young, 1999, “INTERNET MILLENNIUM EDITION” Tata McGraw Hill,
- Krishnan, “COMPUTER FUNDAMENTALS AND WINDOWS WITH INTERNET” technology, SCITECH PUBLICATIONS (INDIA) PVT LTD, 2000

IGYT-24 GEOMORPHOLOGY

UNIT-I: Definition of geomorphic agent, gradation, degradation and aggradation. Weathering—definition of processes, climatic influences and products. Mass wasting - slow flowage types and rapid flowage types.


Books for study and reference

- Fairbridge, R.W, 1968, Encyclopodia of Geomorphology, Reinhold Book Corporation
- Ashutosh Gautam, 2008, Earth quake – A natural Disaster, APH Publishing Corporation

SEMESTER – III

IGYT-33 CRYSTALLOGRAPHY


UNIT-II: Classification of crystals systems and classes- Study of the symmetry elements and forms of the Normal, Pyritohedral, Tetrahedral and Plagiohedral classes of Cubic system with special reference to well developed crystals of Galena, Spinel, Garnet, Fluorite, Diamond, Pyrite, Boracite and Cuprite.

UNIT-III: Study of symmetry elements and forms of Normal, Hemimorphic, Tripyramidal, Pyramidal Hemimorphic, Sphenoidal and Trapezoidal classes of Tetragonal system with special reference to well developed crystals of Zircon, Rutile, Cassiterite, Vesuvianite,

UNIT-IV: Study of Normal, Hemimorphic and Sphenoidal classes of Orthorhombic system with special reference to well developed crystals of Barite, Olivine, Topaz, Staurolite, Sulphur, Calamine, Struvite and Epsomite. Study of symmetry elements and forms of the Normal classes of Monoclinic and Triclinic systems with special reference to well developed crystals of Gypsum, Orthoclase, Augite, Axinite, Albite and Kyanite.

UNIT-V: Twin crystals - Definition - Evidences of Twinning - Twinning plane, twinning axis and composition plane, Laws of twinning, kinds of Twinning – Simple, Contact, Penetration and repeated twins. Polysynthetic and Cyclic twins. Secondary twins. Study of twin laws pertaining to the following crystals; Fluorite, Pyrite, Rutile, Calcite, Quartz, Aragonite, Staurolite, Gypsum, Augite and feldspars. A brief outline of imperfection and irregularities in crystals.

Books for study and reference
- M.J.Buerger, 1956, Elementary crystallography, John Wiley & Sons
- E.S.Dana, 1935  A Text Book of Mineralogy, John Wiley & Sons
- P.R.J.Naidu, 1958, Johansen’s Optical mineralogy, Allied Publisher (P) Ltd
- R.C. Evans, 1966, An introduction to crystal chemistry, Cambridge University Press
- Ernest, E.Walhstrom, 1960, Optical Crystallography, John Wiley & Sons
- M.J.Buerger, 1956 Elements of Crystallography, John Wiley and sons
- Read, H.H, 1961, Rutley’s Elements of Mineralogy, Murby and Co

IGYT-34 PALAEONTOLOGY

UNIT-I: Definition of Palaeontology; General classification of Animal kingdom; Habitats and Habits of animals. Nature and mode of preservation of fossils: Unaltered hard parts, altered hard parts, petrification, permineralisation, carbonisation, recrystallisation,

**UNIT-II:** General morphology, classification, geological history and environmental significance of the following with examples: Phylum- Mollusca - Classes - Pelecypoda, Gastropoda and Cephalopoda; Phylum - Brachiopoda.

**UNIT-III:** General morphology, classification, geological history and environmental significance of the following with examples: Phylum- Echinodermata; Phylum-Coelenterata-Class-Anthozoa (Corals).

**UNIT-IV:** General morphology, classification, geological history and environmental significance of the following with examples: Phylum-Arthropoda-Class- Trilobita; Phylum - Hemichordata- Class- Graptoloidea.

**UNIT-V:** Classification of Plant kingdom; General morphology, classification, geological history and environmental significance of the following: Glossopteris, Gangamopteris, Ptilophyllum, Lepidodendron, Calamites, Sigillaria and Phyllotheca.

**Books for study and reference**

- W.W. Berry, 2003, An Introduction to Paleontology, Sonali publications
- Robert R. Shrock and William H., Twenhofel, 1953, Principles of Invertebrate Paleontology Mc Graw-Hill Book Co
- H.Woods, 1961, Invertebrate Paleontology, Cambridge University press
- Alfred S.Romer, 1963, Vertebrate Paleontology, University of Chicago press
- G.Bigot, 1985, Elements of micropaleontology, Graham & Trotman, London
- H.H.Swinerton, 1961, Outlines of Paleontology, Edward Arnold Publisher Reference Books
- Derek V.Ager, 1963, Principles of Paleoecology, Mc Graw Hill Book Co
- Benton, M.J. 1990, Vertebrate Paleontology, John Wiley
- Unwin Hyman, , 1971, Vertebrate Paleozoology, John Wiley
- J.P.Kennet and M.S.Srinivasan; 1951, Forminifera, W.H.Freeman & Co
- Jones, 1989,Introduction to Microfossils
Crystals

Morphological study of the crystal models representing the following minerals:

1. **Isometric system**: Normal Class: Galena, Garnet, Gold, Fluorite, Copper, Magnetite
   Pyritohedral Class: Pyrite;
2. **Tetrahedral Class**: Tetrahedrite, Sphalerite, Boracite. Plagiohedral Class: Cuprite;
   Tetragonal System: Normal Class: Zircon, Rutile, Vesuvianite, Cassiterite, Apophyllite; Tripyramidal Class: Scheelite, Scapolites; Pyramidal-Hemimorphic Class: Wulfenite; Sphenoidal Class: Chalcopyrite; Trapezohedral Class: Nickel Sulphate
3. **Hexagonal System**: Normal Class: Zincite; Hemimorphic Class: Zincite;
   Tripyramidal Class: Apatite; Hexagonal Trapezohedral Class: Quartz, Rhombohedral Class: Calcite, Haematite, Corundum; Rhombohedral-Hemimorphic Class: Tourmaline; Trirhombohedral Class: Dioptase, Phenacite; TrigonalTrapezohedral Class: Quartz
4. **Orthorhombic system**: Normal class: Barite, Sulphur, Olivine, Topaz, Staurolite, Hypersthen; Hemimorphic Class: Calamine, Sphenoidal Class: Epsomite
5. **Monoclinic System**: Normal Class: Gypsum, Augite, Hornblende, Epidote, Orthoclase

Paleontology

Identification and description of the following fossils:

1. **Brachiopoda**: Lingula, Orthis, Productus, Pentamerus, Rhynoconella, Terebratula, Atrypa, Spirifer and Athyris. Ceras
3. **Gastropoda**: Nautica, Turbo, Turritella, Hamites, Baculites

4. **Cephalopoda**: Natilus, Goniatites, Ceratities, Ammonite, Phyiloceras, Acanthoceras, Scaphites, Turrilites, Belemminites

5. **Arthropoda**: Trilobita; Paradoxides, Olinus, Ollenellus, Calymene, Phacops

6. **Echinodermata**: Crinoids; Encrinus, Marsupites

7. **Blastoidea**: Pentremites

8. **Echinoidea**: Cidarid, Hemicidaris, Holaster, Hemiaster, Micraster.

9. **Hemichordate**: graptoloidea; Tetraraptus, didymograptus, Phyllograptus, Diplograptus, Monograptus, Rastites

10. **Plant fossils**: Calamites, Sphenophyllum, lepidodendron, Sigillaria, Glossopteris, Gangamopteris, Ptilophyllum

**SEMESTER – IV**

**IGYT -43 STRUCTURAL GEOLOGY**

**UNIT-I**: Methods of representing physiographic features: topographic maps, preparation and uses of geologic maps. Attitude of planes-strike and dip of the formation -trends of outcrops and rule of ‘V’, Relationship between true and apparent dips-width of outcrops-true and vertical thickness and their mutual relations.

**UNIT-II**: Definition of stress and strain, compressive and tensile stress, shearing stress, couple and stages of deformation. Folds: Geometry and classification of folds-criteria for recognition of folds in field and map.


**UNIT-IV**: Joints: Joint sets and systems-joint surface-relations of joints to other structures-geometric and genetic classifications. Repetition of outcrops due to erosion, folding and faulting. Inliers and outliers-Nappe-Klippe and Fenster

**Books for study and reference**

- Billings, M.P. 1974, Structural Geology, Prentice Hall of India
- John Suppe 1985, Principles of Structural Geology, prentice Hall publications
- Davis, G.R. 1984, Structural Geology of Rocks and Region, John Wiley
- H.W. Fairborn, 1949, Structural petrology of deformed rocks, John Wiley and sons

**IGYT-44 MINERALOGY**

**UNIT-I:** Definition and scope – general characteristics of minerals – Classification of minerals- physical properties of minerals and their determination. Definition and examples of the following: Isomorphism, Dimorphism, Polymorphism, Isodimorphism, Paramorphism, Pseudomorphism-Molecular and empirical formulae of minerals.


**UNIT-III:** Isotropic minerals – properties observed under parallel nicols. Uniaxial minerals: Properties under parallel and crossed nicols-dichroism -Pleochroism. Biaxial minerals properties observed under parallel and crossed nicols-optic axes, optic normal, optic axial
plane–extinction, extinction angle, interference colors. A brief outline of conoscopic characters of uniaxial and biaxial minerals.

UNIT-IV: Physical and optical properties, chemical composition and mode of occurrence of the minerals of the Silica group, Feldspars, Feldspathoids, Mica, Zeolite, Scapolite, Wollastonite and Rhodonite.

UNIT-V: Physical and optical properties, chemical composition and mode of occurrence of the following minerals-Pyroxenes, Amphiboles, Garnets, Olivine, Epidote, Beryl, Apatite, Cordierite, Staurolite, Tourmaline, Topaz, Zircon, Sphene, Chlorite, Serpentine, Andalusite, Kyanite, Sillimanite, Tale, Kaolin, Fluorite, Calcite, Dolomite, Magnesite and Rutile.

Books for study and reference

- Alexander N.Winchell, 1968, Elements of Optical mineralogy, Parts I and II, Wiley Eastern (P) Ltd
- Ernest, E.Walhstrom, 1960, Optical crystallography, John Wiley & Sons
- E.S.Dana, 1935, A Text Book of, Mineralogy, John Wiley & Sons
- Smith, H.G, 1957, Minerals and microscopes, Allied publishers PVT. Ltd.

Megascopic identification and description of the following minerals in hand specimen:
- **Feldspar Group**: Sandine, Microcline, Amazon stone, Orthoclase, Moonstone, Perthite. **Plagioclase feldspars** – Albite, Oligoclase, Labradorite.
- **Feldspathoid Group**: Leucite, Nepheline, Sodalite
- **Pyroxene Group**: Enstatite, Bronite, Hypersthene, Diopside, Augite, Spodumene.
- **Pyroxenoid Group**: Rhodonite and Wollastonite
- **Amphibole group**: Anthophylite, Tremolite, Actinolite, Hornblende, Glauconphane and Riebeckite.
- **Garnet Group**: Almandine, Pyrope, Andradite
- **Aluminum Silicate Group**: Andalusite, Sillimanite, Kyanite.
- **Clay Mineral**: Kaolin; **Mica Group**: Biotite Muscovite
- **Other minerals**: Beryl, Cordierite, Zoisite, Epidote, Olivine, Zircon, Titanite, Apophyllite, Talc, Staurolite, Topaz and Tourmaline

Microscopic identification and description of the following minerals in thin section:
- **Quartz Varieties**
- **Feldspar**: Orthoclase, Microcline, Albite, Oligoclase, Andesine, Labradorite, Bytownite, Anorthite
- **Feldspathoids**: Leucite, Nepheline, Sodalite
- **Pyroxene**: Enstatite, Hypersthene, Augite, Diopside, Aegirine
**Amphibole:** Hornblende, Actinolite, Tremolite, Reibeckite, Glaucophane

**Mica:** Muscovite, Biotite, Phlogophite

**Others:** Olivine, Epidote, Chlorite, Garnet, Zircon, Sphene, Tourmaline, Andalusite, Kyanite, Sillimanite, Cordierite, Staurolite, Topaz, Calcite and Apatite

### SEMESTER -V

**ICYT-51 IGNEOUS PETROLOGY**

**UNIT-I:** Nature and scope of petrology – the earth shells and the chemical composition of the earth. General classification of the rocks. Composition and constitution of magma - primary magmas. Forms of igneous rocks, extrusive forms – lava flows and pyroclastic deposits, intrusive forms – concordant and discordant forms.

**UNIT-II:** Structure and texture of igneous rocks. Structures – vesicular, amygdaloidal, blocky lava, Ropy lava, pillow structure, flow structure, sheet joints, mural joints, columnar joints, rift and grain. Textures – definition, elements of texture, kinds of textures – equigranular, inequigranular, directive, intergrowth, reaction, Corona, Xenolithic and others.

**UNIT-III:** Principles and parameters in the classification of igneous rocks – Megascopic classification, Shand’s saturation principles. Outlines of classification of igneous rocks - C.I.P.W, Johansson and Tyrrell classification.

**UNIT-IV:** Petrographic characteristics of Granite, Granodiorite, Syenite, Diorite, Gabbro and their hypabyssal and volcanic equivalents. Petrographic characters and origin (brief account) of Pegmatites and Aplites, Lamprophyres, Alkaline rocks, Ultrabasic rocks and Anorthosites.

**UNIT V:** Silicate systems and igneous petrogenesis. Crystallization of unicomponent magma, binary magma - Albite – Anorthite system and incongruent melting MgO – SiO$_2$ system. Bowen’s reaction principle and its bearing on petrogenesis of igneous rocks. Diversity of igneous rocks in space and time – Evidences and theories of differentiation and Assimilation.

**Books for study and Reference**

- Barth, F.W. 1956, Theoretical Petrology, Wiley & sons.
• Johansson, A, 1962, Descriptive Petrology of Igneous rocks, Vol. 1 to IV, Allied Pacific.
• Tyrrell G.W, 1970, The principles of petrology, Methuen & co.
• Mc Birney, 1994, Igneous Petrology, CBS publications, India.

**IGYT-52 STRATIGRAPHY & INDIAN GEOLOGY**

**UNIT-I:** Introduction to stratigraphy. Principles and laws of stratigraphy. Various stratigraphic nomenclatures-Physiographic division of India- a comparative study of physiographic divisions.

**UNIT-II:** Major stratigraphic formations of India. General characteristics and descriptive study with note on the economic importance of the Dharwar rocks in south India. General characteristics and descriptive study with a note on the economic importance of the Cuddapah, Vindhyan and Aravalli systems in India.

**UNIT-III:** General characteristics and descriptive study of the following stratigraphic formations. Cambrian of salt range-Age of saline series, Permo carboniferous of Kashmir-Umaraia marine beds. Triassic of Spiti and Kashmir valley-Jurassic of Kutch, Cretaceous of Trichinopoly

**UNIT-IV:** Gondwana super group -divisions, climate and conditions of sedimentation, economic importance. Deccan trap and their age-inter trappeans and Infra trappeans. Rise of Himalayas.

**UNIT-V:** Eocene of Assam, Oligocene and Miocene of Assam, Cuddalore sandstone, Rajahmundry sandstone, Warkala beds, Quilon beds. Conditions of deposition and faunal content of Siwalik system – Karewa series.
Books for study and reference

- Gignox, M.1955, Stratigraphic Geology, W.H.Freeman & Company
- Ravindra Kumar, 1985, Fundamentals of Historical Geology and Stratigraphy of India,
- Bowen, D.C. 1978, Quaternary Geology, Pergamon press.

IGYT- 53 BASICS OF REMOTE SENSING, GIS & GPS

UNIT-I: Photogeology, definition, types of aerial photographs, scale, causes for the variation of scale, flight procedure, overlap and side-lap. Mosaics, Aerial cameras, types of films & filters, stereoscope and stereopair. Fundamentals of aerial photo interpretation – analysis based on drainage, landform and vegetation.

UNIT-III: Image Processing System – Introduction and basic principles of image processing
- Digital image formats - band sequential, band interleaved format – Image corrections and rectification


UNIT V: Principles of Global Positioning System (GPS)-segments; user, ground and space segments -Differential GPS-Real Time Kinematic GPS - application of GPS in geological studies - mobile GPS.

Book for study and reference

- Ian Heywood, Sarah corrdius and Steve Carver, 2000, An Introduction to Geographical system (GIS), Longman Ltd, Newyork.


UNIT IV: Environmental geology: Definition of ecology and environmental geology. Different ecosystems. A short account of renewable and nonrenewable resources. Environmental problems due to surface geological processes, cause, hazards and remedial measures relating to landslides, floods, and soil erosion, impact of wind on environment.


Book for study and reference

- Bharat. B. Dhar, 2000, Mining & Environment, APH publishing Co.
Megascopic identification and description of the following rocks in hand specimen:

Microscopic identification and description of the following rocks in thin section:
**Acid igneous rocks**: varieties of granites and Rhyolites, Pegmatite- Aplite, and Rhyodacite, Granodiorite and Dacite.
Intermediate Rocks: varieties of Syenite and Trachyte, Monzonite and Trachy andesite, Diorite and Andesite, Feldspathoidal syeniite and Phondite.

Basic and ultramafic Rocks: Varieties of Anorthosites and related rocks; Gabbro, Basalt, Norite, Pyroxenite, Dunite, Dolerites, Peridotites.

**PRACTICAL-IV**

**IGYP 56-HYDROGEOLOGY, REMOTE SENSING & GIS**

**HYDROGEOLOGY**


**PHOTOGEOLOGY:**

a. Stereo vision test and study of different types of Aerial photographs
b. Base line information’s and orientation of Aerial Photos under mirror Stereoscopes
c. Determination of photo scale
d. Tracing details from stereogram and stereo pairs after extracting basic interpretation
e. Identification of landforms
f. Preparation of land use map
g. Identification and interpretation of drainage patterns
h. Identification of geological, geomorphologic and structural features

**REMOTE SENSING:**

A. Study of topographic maps - tracing the details obtained from topographic maps
B. Tracing drainage basin and drainage net works from topographic maps
C. Marginal information of Satellite images
D. Preparation and interpretation of geomorphic landforms
E. Preparation of Lineaments map
F. Preparation of land use map
DIGITAL IMAGE PROCESSING
a. Starting ERDAS imagine and exploring the viewer interface
b. Identifying image statistics, Histogram, contrast enhancement
c. Band ratios, filters, georeferencing / rectification & subset image
d. Principal Component Analysis
e. View images and Map composer

GEOGRAPHIC INFORMATION SYSTEM
A. Data encoding - Scanning and conversion of images
B. Conversion of degree minute seconds to decimal degrees
C. Digital Map - Registration
D. Projection and Transformation

SEMESTER VI

IGYT-61 SEDIMENTARY AND METAMORPHIC PETROLOGY

UNIT I: History of sedimentary rocks; weathering and sedimentary cycle, Nature and origin of Sedimentary rocks- composition, fabric and general classification; Textural characteristics of sedimentary rocks; Physical properties of particles - surface textures, particle shape, sphericity and roundness, particle size, crystalline textures and biogenic textures.

UNIT II: Internal organization and structure of sedimentary rocks-Physical Structure, Biogenic structure and Diagenetic structures, characteristics of primary structures. Classification and petrography of Clastic rocks–Rudaceous, Arenaceous and Argillaceous.

UNIT III: Classification and petrography of Non Clastic rocks-Dunham’s and Folk’ Classification of Carbonate rocks, Chert, Glauconite, Phosphorites, Carbonaceous rocks; Classification of concretions, nodules and other segregates.

UNIT V: Dynamo thermal metamorphism and its significance–plutonic metamorphism–metasomatism and metasomatic process–pneumatolytic metamorphism–Skarn rock -injection metamorphism and auto metamorphism, petrographic description of the following rock type – Quartzite, Slate, Schist, Gneiss, Marble, Hornfels and Charnockites.

Books for study and reference

- Nichols, H. G. 1999, Sedimentary environments, Blackwell
- Wilson, J.L, 1975, Carbonate facies in geological history, Springer Verlag, New York
- Alex Maltman, 1994, The geological deformation of Sediments, Chapman & Hall publishers
- Wilson, J.L, 1975, Carbonate facies in geological history, Springer & Verlag, New York
- Butcher and Frey, 1994, Petrogenesis of metamorphic rocks, Springer Verlag
- G.W.Tyrrell, 1989, Principles of petrology, Methureyn and Co., (Students Ed.)
• R.H.Vernon, 1976, Metamorphic process, George Allen and Unwin Ltd.
• Roger Mason, 1984, Petrology of the Metamorphic rocks, CBS Pub. & Distributors.

**IGYT-62 ECONOMIC GEOLOGY AND MINERAL ECONOMICS**

**UNIT I:** An outline of the processes of formation of mineral deposits. Magmatic, Sublimation, Contact metasomatic, Hydrothermal, Residual, Placer, Oxidation and Supergene enrichment, evaporation. Classification of ore deposits–Lindgren’s and Bateman’s classification.

**UNIT II:** Important ores, their composition, mode of occurrence, uses and distribution in India with reference to the following metals; Aluminum, Gold, Copper, Lead, Zinc, Iron, Manganese, Chromium, Uranium and Thorium.

**UNIT III:** Raw material required for the following industries and their qualities, mode of occurrence and distribution in India; Refractory, Abrasive, Ceramic, Glass, Cement, Paint and Pigment, Fertilizer, Building stones and gemstones – their mode of occurrence and distribution in India.

**UNIT IV:** Mode of occurrence, origin, use and distribution in Tamil Nadu of the following mineral deposits: Iron ores of Kanjamalai, Gauthimalai, Magnesite and Bauxite deposits of Shevaroy hill, Gypsum beds of Chaitali, Graphite beds of Sivaganga, Quartz deposits of Karur region, Clay beds of Cuddalore and Trichinopoly. Lignite beds of Neyveli.

Books for study and references

- Alan M. Bateman, 1961, Economic mineral deposits, Asia Publishing House, Mining Geology
- Evans, A.M., 1993, Ore Geology and industrial minerals, Blackwell
- K.V.G.K. Gkhale and T.G. Rao, 1972, Ore deposits of India, Thompson press Ltd., Delhi
- N.K.N. Aiyengar, 1964, Minerals of Madras, Dept. of Industries and Commerce, Madras
- Lindgren, 1953, Mineral deposits, McGraw Hill
- A. Levorsen, 2004, Geology of petroleum 2nd Ed, CBS publication
- Stephan E. Kesler, 1904, Mineral Resources, Economics and the environment, Macmillan publications

IGYT-63 GEOEXPLORATION

UNIT I: Geological exploration: marginal information of toposheets and study of field equipment. Pitting and trenching the ore bodies. An introduction to drilling—types and uses, sampling.

UNIT II: Geophysical Exploration: a concise account of limitations and applications of various geophysical exploration methods; principles, instruments, field procedures and interpretations of electrical methods with particular reference to resistivity—Self potential methods.


Book for study and references
- McKinstry H.E, 1960, Mining Geology; Asia Publishing House
- Mathur S.M, 2001, Guide to Field Geology; Prentice Hall of India
- Ramachandra Rao M.B, 1975, Outlines of Geophysical Prospecting – A manual for Geologist, University of Mysore
- D.A. Cox, 1995, The elements of Earth, Oxford University Press, Newyork
- Sharma, P.V, 1986, Geophysical methods in Geology, Elsevier.
- Govett, G.J.S. (Ed), 1983, Handbook of Exploration Geochemistry, Elsevier,
- Pascal, 2nd Ed., 1977, Geophysical prospecting methods, Ustrendi.
IGYT-64 MINING GEOLOGY & ENGINEERING GEOLOGY

UNIT–I: Role of geology in mining industries. Introduction to ore body investigation methods. Lithological association of ore minerals. Rock sampling techniques. Ore reserve estimation techniques. Definitions of mining terms: hanging wall, foot wall, shaft, adit, roof, drive, cross cut, tunnel, raise, winze, stope, assay value, cut off grade and run off mine.


Books for study and reference

- B.Boky, 1967, Mining, Mir publishers, Moscow.
- C.J.Young, 1940. Elements of Mining , Mc Graw Hill Book co.,
• H.E. Mc Kinstry, 1960. Mining Geology, Asia publishing house
• K.Subramanya, 1994, Engineering Hydrology, Tata Mc Graw Hill
• R.N.P.Arogyaswami, 1970. Course in Mining Geology, Oxford and IBH Publishing house,
• US. Department Interior Bureau of Reclamation, 1989, Engineering geology field manual, Scientific publications.

PRACTICAL-V

IGYP 65-SEDIMENTARY AND METAMORPHIC PETROLOGY

Megascopic identification and description of the following rocks in hand specimen:

Sedimentary:
Conglomerate, Breccia, Sandstone, Arkose, Grit, Flagstone shale, Laterite, Limestone, Clay, Chalk, Flint, Chert, Phosphatic Nodule, Peat, Lignite, Bituminous Coal, Anthracite

Metamorphic:
Mica gneiss, Hornblende schist, Chlorite Schist, Chlorite mica schist, Chlorite garnet schist, Mica garnet schist, Mica Staurolite schist, Talc schist, Graphite Schist, Phyllite, Grayscale, Red slate, Quartzite, Marble, Dolomite, Ophicalcite, Quartz magnetite rock, Amphibolite, Eclogite, Khondalite, Gondite, Charnockite, Calegranulite
Microscopic identification and description of the following rocks in thin section:

**Sedimentary:**
- Conglomerate, Breccia, Sandstone, Arkose, Grit, Shale, Laterite, Limestone, Oolitic limestone, Shell limestone, Clay, Chalk, Flint, Chert, Coal.

**Metamorphic:**
- Mica schist, Chlorite schist, Hornblende schist, Staurolite schist, Actinolite Schist, Tremolite schist, Garnetiferous mica schist, Slate, Mica gneiss, Pyroxene gneiss, Charnockite, Marble, Eclogite, Amphibolites, Khondalite, Cordierite sillimanite gneiss.

**PRACTICAL - VI**

**IGYP 66 ECONOMIC GEOLOGY & ENGINEERING GEOLGY**

**ECONOMIC GEOLOGY**

Identification and description of the following economic minerals:

**Reserve Estimation Methods:**

i) Section – Preparation of isochore and isopach maps.

ii) Estimation of ore reserves by distance of influence methods: included and extended area, triangular and polygonal methods.

iii) Reserve calculation for hydrocarbons, coal seams and placer deposits from maps

**ENGINEERING GEOLGY**

Engineering applications of Geology in the planning and construction of dams and reservoirs. Study of maps and models of important engineering structures as dam sites and tunnels. Study of properties of common rocks with reference to their utility in engineering projects. Important case studies of Dams. Prevention of leakage reservoirs and silting of reservoirs. Tunnels, engineering properties of rocks. Flood control - Soil conservation.
SEMESTER VII

IGYT-71 GLOBAL TECTONICS & PETROFABRICS


Books for study and reference

- Davies, F, 1999, Dynamic Earth, Cambridge University Press
- Billings, M.P, 1974, Structural Geology, Prentice Hall of India
- Leopold, L.S. et.al.,1964, Fluvial processes in Geomorphology, Eurasia Publishing House, New Delhi
- Fairbridge, R.W. 1968, Encyclopedia of Geomorphology, Reinhold Book Corporation
- Ravindra kumar 2008 Fundamentals of Historical geology and stratigraphy of India, New Age International (P) Limited Publishers
- Allen Cox, 1973, Plate Tectonics, Freeman & company
- L.Rama Rao , 1964, The problem of the Cretaceous – Tertiary Boundary with special Reference to India and adjacent countries , GSI Memoir No:2
- B.P. Radhakrishnan Etd., 1968, Cretaceous – Tertiary formations of south India, Geological society of India, GSI Seminar Volume
IGYT 72 MARINE GEOLOGY


UNIT-II: Ocean morphology: Continental margin, Shelf, Slope, Rise, Submarine canyons, Oceanic ridges, Abyssal hills, Seamounts and Guyots and Trenches. Plate tectonics and origin of ocean basins: Ocean circulation causes and character, surface currents, deep water circulation.


Books for study and reference

- J.J. Bhatt, 1980, Oceanography- Exploring the Planet Ocean, D.Van Nosrand Company, USA
- Kuenen, Ph.H. 1950, Marine Geology, John Wiley & Sons
- D.S. Cronon, 1996, Under water minerals, Kluwa publications
- Kingh, 1974, Oceanography, CBS
- E. Ahmed, 1982, Coastal geomorphology of India ,CBS
- PC. Sinha, 1994, Sea level rise, CBS
IGYT-73 COAL & PETROLEUM GEOLOGY


UNIT–IV: Introduction to drilling methods, types of drilling operations, designing an oil well and down hole equipment. The drilling rig - its components and functions. Drilling fluids, Wellheads, Casing and cementing operations. Principles of kick control, fishing jobs. Drilling methods and equipment for directional, horizontal and multilateral wells. Types of offshore drilling rigs.

Books for study and reference

- A.L. Levorson, , 1972, Geology of Petroleum, Vakils, Peter and Simon Limited, Bombay,
- E.S. Moore, 1980, Coal, John Wiley & Sons
- Baker, R. A, 2001, Primer of Oil well Drilling: A Basic Text of Oil and Gas Drilling, Petroleum Extension Service, University of Texas at Austin
- Chilinger, G.V. and Vorabutr, P. 1981, Drilling and Drilling Fluids. Elsevier Science, Amsterdam
- Singh, L. 2000, Oil and Gas Field of India, Indian Petroleum Publishers, Dehra Dun
- Ross C.A, 1984, Geology of Coal, Narosa book distributors

**IGYP-74 PRACTICAL-VII SURVEY**

- Chain, Plane table and principles of Levelling by dumpy level-principles of theodolite and microptic alidade-preparation of base maps by radial contouring and block contouring methods and marking of geological formation in them. Study of GPS.
SEMESTER VIII

IGYT-81 ADVANCED CRYSTALLOGRAPHY, MINERALOGY & OPTICS

UNIT-I: Crystalline and amorphous states of matter, symmetry elements, translation, rotation, reflection, inversion, screw and glide-point groups and crystal classes-Derivation of 32 crystal classes based on Schoenflies notation-Hermann Mauguin system. Correspondence between Schoenflies and international notation-Bravies lattices and their derivation-An outline of space groups.


UNIT-IV: Description of chemical, optical and physical properties, distinguishing features, paragenesis of the following important minerals: Quartz group, Feldspar group, Feldspathoid group, Zeolite group and Scapolite group. Chain silicates: Pyroxene group, Amphibole group & Wollastonite. Sheet silicates: Mica group, Chlorite group and Clay minerals.

UNIT-V: Description of chemical, optical and physical properties, distinguishing features, paragenesis of the following important minerals: Ortho and ring silicates: Olivine group, Garnet group; Alumino silicates, Epidote group, Zircon, Staurolite, Beryl, Cordierite and Tourmaline. Non-silicate- Spinel group, Carbonates and Phosphates. Properties of precious and semi-precious minerals.
Books for study and reference

- Ernest,E.Walhstrom, 1960, Optical Crystallography, John Wiley & Sons
- E.S.Dana, 1935, A Text Book of Mineralogy, John Wiley & Sons
- L.G.Berry Mason, 1961, Mineralogy, John Wiley & Sons
- Read.H.H, 1982, Rutley’s Elements of Mineralogy, CBS, publishers
- American mineralogist special volumes on Mineralogy

IGYT-82 ORE GENESIS AND INDUSTRIAL MINERALS


UNIT-II: Detailed study of precious and ferrous metals with regard to their mode of occurrence, distribution in India, origin and uses: Gold, Silver, Iron, Chromium, Manganese and Molybdenum.
UNIT-III: Study of non-ferrous metals with regard to their mode of occurrence, distribution in India, origin and uses: Copper, Lead & Zinc, Tin, Aluminum, Radioactive metals and rare metals.

UNIT-IV: Study of non-metallic minerals with regard to their mode of occurrence, distribution in India, origin and uses: Abrasive minerals, Building materials, Dimensional & Polished stones, Refractory minerals, Ceramic minerals, Fertilizer minerals and Gem stones. Granite industries in Tamil Nadu.


Books for study and reference:
- C. Schouten, 1962, Determinative tables for Ore Microscopy, Elsevier Publishing Company
- Eugene N. Camer, 1961, Ore microscopy, John & Wiley & Sons,
- James R. Craig and David. J. Vaughan, Ore microscopy and Ore petrography, John & wiley and Sons.
- Sawkins, F.J. 1984, Metal deposits in relation to Plate tectonics, Springer Verlag.
- Barnes, H.L. 1979, Geochemistry of Hydrothermal ore deposits, John Wiley
IGYT-83 MINERAL BENEFICIATION
(Department of Chemical Engineering)

UNIT-I: General principles-Ores, ore types and properties-Scope of ore dressing. A description study of the following Unit operations: Size reduction: Fundamentals-Methods-Preliminary breaking-Jaw crushers-Different types-Jaw and Gyratory crushers-Comparison of disintegrators-Rolls, steam stamps, gravity stamps and stamping.


Books for study and reference

- Jain S.K., 1986, Ore processing, Oxford and IBH publishing Co., Pvt. Ltd., New Delhi,
- A. F. Taggart, 1955, Hand book of Mineral dressing, John Wiley and Sons,
- Gilchrist, 1967, Extractive Metallurgy, Wiley Eastern, New Delhi,
IGYO 84 Optional – I FIELD GEOLOGY

**Objective:** The paper aims to understand the field essentials like understating a map, the basic equipments, traversing and field markings

**UNIT-I:** Previous Literature and Maps, Destruction of Rocks, Physiography, Topographic Expressions and Relief, Inliers and Outliers, Soils and Vegetation, Requirements for the Field, Some Field Suggestions and Precautions.

**UNIT-II:** Basic equipment, Additional requirements, Supplementary supplies, Special requirements, Optional, For mapping on aerial Photographs. Geological Hammers, Pocket and Hand Lenses, Hydrochloric Acid, Streak Plate, Pocket Knife, Measuring Tapes and Scales, Haversack or Rucksack, Mohs scale of Hardness, Cold Chisel, Protractors, Pocket Calculator, Cameras, Care and Upkeep of Instruments.

**UNIT-III:** The Compass and Its Uses, Dip of the Compass Needle, Magnetic Declination, Clinometer, Bearing and Reading Directions, Measuring Attitudes, Handling of the Compass, Finding Direction without a Compass.

**UNIT-IV:** Base Maps, Scale of Maps, Direction of Relief, Latitudes and Longitudes, Map Grids Measurement of the Map Areas, Mounding and Folding of Field Maps, Marking on Maps.

**UNIT-V:** The Notebook, Notes, Checklist for Notes, Writing Materials, Field Sketches and Drawings, Field Photographs. Trimming of Hand Specimens, Fossil Specimens, Mineral Specimens, Samples and Samplings, Numbering and Labelling of Specimens, Packing and Storage.

**BOOKS FOR REFERENCE**

- Davis, G.R. 1984, Structural Geology of Rocks and Region, John Wiley
- H.W. Fairborn, 1949, Structural petrology of deformed rocks, John Wiley and sons
- John Suppe 1985, Principles of Structural Geology, prentice Hall publications
PRACTICAL –VIII

IGYP 85-MINERALOGY, CRYSTALLOGRAPHY & MINERAL OPTICS & ORE PETROLOGY

Megascopic and microscopic study of important rock forming group of minerals:


Optic signs of uniaxial and biaxial minerals. Determination of cell dimensions and identification of minerals from X-Ray Diffractogram.

Crystallography

Goniometric measurement of interfacial angles –stereographic projections of crystals – Calculation of axial ratios, miller indices of faces, application of Weiss zone law, Tangent relationships, Napier's rule, law of anharmonic ratio and equation to normal.

Ore Petrology

Study of mineralogy, texture and paragenesis of ore sections like Magnetite, Hematite, Ilmenite, Pyrite, Chalcopyrite, Sphalerite, Galena, Pyrolusite, Psilomelane, Chemical analysis of economic minerals.

IGYP-86 PRACTICAL-IX - MINERAL DRESSING

Crushing and grinding Tests - Sieve analysis - Air apparatus – Elutriation - Hydraulic classifiers - Wilfley tables - Flotation methods of separation - settling tests, sink and float - Filters and driers. Separation of minerals by different methods
SEMESTER IX

IGYT-91 ADVANCED IGNEOUS & METAMORPHIC PETROLOGY

UNIT-I: Petrogenetic significances of forms, textures and structures of igneous rocks - Classification of igneous rocks - Mineralogical and chemical. Niggli and Streikeissen - IUGS-Classification -Phase-equilibrium studies of binary and ternary silicate system: Albite-Anorthite system, Albite-Anorthite-Diopside system. Anorthite-Forsterite-Silica system, Diopside – Forsterite - Silica system with reference to petrogenesis of igneous rocks - Crystallization of basaltic magma in relation to the tectonic setting. Basalt magma-Sea water interaction.

UNIT-II: Petrography and petrogenesis of Granites, Pegmatites, Alkaline rocks, Monomineralic rocks: Anorthosites, Dunites, Pyroxenite, Lamprophyres, Carbonatites, Charnockites and Ultramafics.


Books for study and reference

IGYT-92 ADVANCED STRATIGRAPHY, SEDIMENTOLOGY AND MICROPALAEONTOLOGY

UNIT-I: International stratigraphic code, lithostratigraphy, biostratigraphy and chronostratigraphic units, geological, biological and physical events, their geological time. Principle and application of seismic, sequential, chemo and magneto stratigraphy.


Books for study and reference
- Roy Lindholm, 1989, A Practical Approach to Sedimentology, Allen and Unwin, USA.
- Nichols, H. G,1999, Sedimentary environments, Blackwell
- J.P. Kennet and M.S. Srinivasan, 1951, Foraminifera, W.H.Freeman & Co.,
- Wilson, J.L, 1975, Carbonate facies in geological history, Springer Verlag, New York,
- Gary Nichols, 1999, Sedimentology and Stratigraphy, Blackwell Science Ltd., London,
• Folk, R.L. 1961, Petrology of Sedimentary rocks, Hemphills,
• Alex S.D. Maltman, 1994, The geological deformation of sediments, Chapman Hall,

**IGYT-93 GEOLOGICAL AND GEOPHYSICAL EXPLORATIONS**

**UNIT–I:** Reconnaissance Vs detailed mapping, surface mapping; Degree of precision, choice of scales, isolation of outcrops. Sampling, general principles, methods of sampling, channel, chip, grab etc. Various drilling techniques. Sampling errors, precautions against salting.

**UNIT–II:** Topographic expression of ore bodies, physiographic relations of placer deposits, guides to channels, location of pay streaks, Physiography in relation to oxidation & enrichment. Residual ores, supergene sulphide zones; mineralogical guides: Rock alteration, nature of alteration, target rings of mineral distribution.

**UNIT–III:** Stratigraphic and lithological guides: supergene deposits, reasons for favorability, competent Vs incompetent formations. Examples of favorable formations. Fracture pattern as guides: (Structural guides): Mechanical principle of fracturing, vein patterns. Contacts and folds as guides: folds younger than the ore-folds older than ore; dislocated ore bodies. Persistence of ore in depth: probable position and shape at deeper levels pitch and changes in shape.


field procedures and application and interpretation. Principles of well logging methods – application in ground water and petroleum.

**Books for study and reference**

- Sharma, P.V. 1986, Geophysical methods in Geology, Elsevier.
- H.E. Mc Kinstry, 1960, Mining Geology, Asia publishing house,

**IGYT-94 GEOCHEMICAL EXPLORATION AND ISOTOPE GEOLOGY**


**UNIT-II:** Geochemical Exploration: Principles of geochemical exploration. Geochemistry in Mineral Exploration - Geochemical environment-Geochemical cycle – Dispersion, Mobility, Association and Distribution of elements. Methods of geochemical exploration-(a) Lithogeochemical prospecting (b) Hydrogeochemical prospecting (c) Biogeochemical prospecting (d) Geobotanical prospecting. Geochemical prospecting models for petroleum and natural gas; geochemical prospecting in marine environment.


Books for study and reference

- Arthur Brown low 1982, Geochemistry, Prentice Hall
- V.M. Goldschmidt, 1954, Geochemistry, Oxford University Press.
- Rankama and Sharma, 1950, Geochemistry, University of Chicago Press
- Faure, G. and Powell, J.L., 972, Strontium Isotopes Geology, Springer Verlag.
- Pascal, 2nd Ed. 1977, Geochemical prospecting methods, Ustrendi

**PRACTICAL-X**
**IGYP 96-GEOEXPLORATION & GEOCHEMISTRY**

**GEOCHEMISTRY:**
Sample preparation for geochemical analysis. Preparation of A and B solution. Major and minor elemental analysis by using spectrophotometer, flame spectrometer and titrimetric methods.

Preparation of geochemical anomaly maps and interpretation based on statistical analysis of data. Determination of background threshold values from maps.

REE distribution patterns of igneous rocks. Problems of geological interpretation of geochemical data.

Calculation of C.I.P.W. Norm, Niggli values, Variation diagrams of Harker and Niggli. ACF, AKF diagrams.

**GEOPHYSICS:**
PRACTICAL-XI

IGYP 97-PETOLOGY, SEDIMENTOLOGY & MICROPALAEONTOLOGY

PETROLOGY:

Preparation of thin sections of rocks - Megascoptic and Microscopic identification - Texture, Structure and Petrogenesis.

Igneous Rocks:

1. Charnockite, Granite, Rhyolite and Dacite
2. Syenite, Neplhene Syenite, Trachyte, Diorite, Andesite
3. Anorthosite, Gabbro, Pyroxenite, Dunite, Basalt

Metamorphic Rocks:

4. Granitic gneiss, Hornblende Biotite Gneiss, Quartzite, Mica Schist, Eclogite

Sedimentary Rocks:

5. Conglomerate, Breccia, Sandstone, Arkose, Grit, Shale, Laterite, Limestone, Oolitic limestone,

SEDIMENTOLOGY:

Mechanical analysis of sediments. Statistical analyses of grain size data. Plotting of size analysis data. Determination of roundness and sphericity of grains. Separation of heavy minerals and study of their microscopic characteristics.

MICROPALAEONTOLOGY:

Methods of separation of microfossils. Identification of selected taxa of microfossil groups under the stereo binocular microscope and observation of morphological characters of some particular species. Benthic and Planktonic foraminifera – Interpretation of environmental significances.
SEMESTER X

IGYT-101 ADVANCED HYDROGEOLOGY, REMOTE SENSING & GIS

UNIT-I: Hydrostratigraphic units - pumping test analysis and determination of hydrological parameters of aquifers - well inventory studies - water budgeting and management of groundwater - Recharge - artificial and natural - factors controlling recharge. Introduction to groundwater modeling.

UNIT-II: Methods of groundwater surface and subsurface prospecting — Geophysical resistivity method, Bore well design and development - saltwater intrusion – Stable isotopes in water cycle – relationship between $^{18}O/^{16}O$ and $^2H/\text{H}$ in natural waters. Isotope effect in precipitation - continental, amount, seasonal, temperature, latitude and altitude. Applications of Tritium, $^{14}C$ and $^{13}C$ isotopes in hydrogeology.


UNIT-IV: Geographic information system (GIS) – Concept and types of map projection. Raster and vector data models, DEM / DTM model, Spaghetti model. Advanced data models – Grid model, TIN model, Network model


Books for study and reference
H.M.Ragunath, 1983,Ground water, John Wiley & sons,
Sabbins, F.F, 1985, Remote sensing principles and application, Freeman, Sanfrancisco.
Verstappan, TH, 1977, Remote sensing in Geomorphology, Elsevier scientific publishing co., Amsterdam.
PeterA.Burrough and Rachael A.McDonell, 1998, Principles of Geographical information systems, Oxford University press.
IGYT 102 MEDICAL GEOLOGY

OBJECTIVE:

The geochemistry of the environments have a marked influence on their health, giving rise to diseases that affect millions of people. This paper aims to expose the students on the interaction of human beings with the geochemistry of the earth environment.

Unit-1 EARTH ENVIRONMENT

General characteristics of tropical, subtropical environments, arid zone, seasonally dry tropics and sub-tropics, humid tropics, and sub-tropics zone and mountainous zone. Rock weathering and soil formation, weathering of mineralized terrains, weathering profiles. Weathering and formation of secondary minerals. Chemistry of weathering of ultra-basic rocks.

Unit-2 MEDICAL GEOLOGY AND SOURCES OF UPTAKE

Unit-3 PATHWAY AND EXPOSURE OF HAZARDOUS PARAMETERS


Unit-4 MEDICAL GEOLOGY OF IODINE, NITROGEN AND SELENIUM


Unit-5 ENVIRONMENTAL TOXICOLOGY AND MINERALOGY OF BONES

Environmental Toxicology, Environmental Epidemiology, Environmental Medicine, Environmental Pathology, Speciation of Trace Elements. Techniques and Tools- GIS in Human Health Studies, Investigating Vector-Borne and Zoonotic Diseases with Remote Sensing and GIS. Mineralogy of Bones, Inorganic and Organic Geochemistry Techniques, Histochemical and Microprobe Analysis in Medical Geology.

Books for study and reference


INTERNAL OPTION
(For students of M.SC Geology Integrated)

Optional –III

IGYO 103 ENVIRONMENTAL GEOSCIENCES & DISASTER MANAGEMENT


UNIT IV DISASTER MANAGEMENT AND PHASES OF CLASSIFICATION


UNIT V DISASTER MANAGEMENT AND OVERPROTECTIVE TECHNIQUES


Books for study and reference

- Upendra Kumar Sinha, 1986, Ganga-Pollution & Health Hazard Inter-India publication, New Delhi.

**INTERNAL OPTION**
(For students of M.SC Applied geology Integrated)

**OPTIONAL – IV**

IGYO 104 – GEOLOGICAL INSTRUMENTATION & ANALYTICAL TECHNIQUES

**Unit I:** Rock sample collection, Sediment sample collection, Water sample collection, samples for geochemical study. Collection of samples from exposed materials. Samples acquired from drilling operations. Sampling apparatus-Scraper or drag bucket type of sampler, coring tube samplers, Snapper or grab bucket samplers, Rod samplers, Chambered weight samplers, Ripple mark samplers, Sediment traps.

**Unit II:** Sample preparation for thin section of hard rocks and sediments. Preparation of Polished ore and thin section for petrographic study. Sample etching, staining and modal count techniques. Techniques of photomicrography. Thin section preparation of heavy minerals and identification.

**Unit III:** Separation of minerals - Magnetic separation - Dielectric separation of mineral particles. Electrostatic separation - panning- rolling, sieving and hand picking.

**Unit IV:** Determination of major and minor elements. Principles of geological application of Cathodoluminiscence, Atomic absorption spectrophotometry, inductively coupled plasma-atomic emission spectrometry.


**Books Recommended**

PRACTICAL – XIII

IGYP 105-HYDROGEOLOGY, REMOTE SENSING AND GIS

Hydrogeology

a. **Pumping test:** time - drawdown and time - recovery tests and evaluation of aquifer parameters. Processing of the pumping test data by Cooper, Theis, Jacob and Walton methods.

b. **Geophysical methods:** Electrical resistivity sounding for delineation of fresh and saline aquifers. Identification of favorable zones for groundwater and design of well. Interpretation of well logs, resistivity, SP. Estimation of TDS using resistivity and SP logs.

c. **Chemical analysis:** Chemical analysis of major dissolved constituent of groundwater and graphical representation. Interpretation of quality for various uses. Exercises on groundwater exploration using remote sensing techniques.

Aerial Photography

a) Drainage analysis – pattern reorganization and extracting lithology and structural control. Drainage density, stream frequency and Stream ordering.

b) Lithology determination using photo recognition elements.
Remote Sensing:

a) Preparation and interpretation of coastal land forms, fluvial landforms, lineaments and land use map.

b) Demarcation of groundwater potential zone, coastal vulnerability, hazard zone mapping and land use change detection

Image Processing:

f. Band ratios, filters, georeferencing/ rectification & principal component analysis

 g. Information extraction and mosaic

h. Image enhancement techniques – spatial – spectral – radiometric corrections

i. Supervised and Unsupervised classification

j. View images and Map composer

GIS:

a. Calculation of total area of the topographic map

b. Calculation of per degree distance of latitude and longitude

c. Digitization of points, lines and polygon features

d. Creation of table structure

e. Buffer analysis of point, line and polygon features

f. Map layout

IGYO -106 DISSERTATIONS AND VIVA –VOCE

Each student in the beginning of X –semester should choose a topic of dissertation in the field related to their Industrial / institutional training and work with a guide, who one among the teacher, in the department. At the end of the semester should submit a dissertation not exceeding 150 pages inclusive of tables and illustrations. Evaluation will be made on the basis of merit of the dissertation and performance in the viva-voce.