

UNIVERSITY OF KERALA

(Abstract)

First Degree Programme in Geology under CBCS system – Scheme and Syllabus – Modified – with effect from 2013 admissions – Approved – Orders issued.

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ACADEMIC 'A V' SECTION

No. Ac. A V/1/31970(8)/2012

Dated, Thiruvananthapuram, 26.06.2013

- =====
- Read:- 1. U.O. No. Ac A II/2/36951(Geol)/2010 dated 31.03.2010.
2. Minutes of the annual meeting of the Board of Studies in Geology (Pass) held on 15.11.2012.
3. Minutes of the annual meeting of the Faculty of Science held on 20.03.2013.
4. Item 5, Minutes of the meeting of the Academic Council held on 22.05.2013.

ORDER

The Scheme and Syllabus of First Degree Programme in Geology under CBCS system had been approved by the special meeting of the Academic Council held on 22.03.2010 and accordingly U.O. vide paper read as (1) had been above.

The annual meeting of the Board of Studies vide paper read as (2) above recommended revision of Scheme and Syllabus of First Degree Programme in Geology under CBCS system and Faculty of Science has endorsed the same.

The Academic Council vide paper read as (4) above, has approved the revision of Scheme and Syllabus of First Degree Programme in Geology under CBCS system as recommended by the Board of Studies in Geology (Pass) and as endorsed by the Faculty of Science. The revised syllabus will come into effect from 2013 admissions onwards.

A copy of the revised Syllabus is appended.

Orders are issued accordingly.

Sd/-

NASEEMA BEEVI. M
DEPUTY REGISTRAR (Acad. II)
For REGISTRAR

To

1. The Principals of Colleges offering First Degree Programme in Geology under CBCS system
2. The Dean, Faculty of Science
3. The Chairman, Board of Studies in Geology (Pass)
4. The Controller of Examinations
5. The Director, Computer Centre
6. JR (CBCS) / DR (CBCS)
7. AR (CBCS) / EB (CBCS)
8. B.Sc. (CBCS) / EB. (CBCS) sections
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SECTION OFFICER

Na

UNIVERSITY OF KERALA

Course Structure and Syllabus for First Degree Programme

in

GEOLOGY

(Core & Complementary)

Under Choice Based Credit Semester System

(with effect from 2013 admission onwards)

First Degree Programme in Geology

Subject:

| Sem No. | Course Title B.Sc. Degree Geology | | Instructional hours / week | | Credits | Uty Exam Duration | Evaluation | | Total credits |
|---------|--------------------------------------|---|----------------------------|---|---------|-------------------|------------|----------|---------------|
| | | | L | P | | | Internal | Uty Exam | |
| I | EN IIII | Language Course (English I) | 5 | - | 5 | 3 hrs | 25% | 75% | 18 |
| | IIII | Language Course II (Addl. Language I) | 4 | - | 3 | 3 hrs | 25% | 75% | |
| | EN 1121 | Foundation Course I (English) | 4 | - | 2 | " | " | " | |
| | MM 1131.3 | Complementary Course I | 4 | - | 3 | " | " | " | |
| | PY 1131.4/C | Complementary Course II | 2 | 2 | 2 | " | " | " | |
| | H 1131.2 | Core Course I | | | | | | | |
| | GL 1141 | General Perspective of Geology | 4 | - | 4 | " | " | " | |
| II | EN 1211 | Language Course III (English II) | 5 | - | 4 | " | " | " | 18 |
| | EN1222 | Language Course IV (English III) | 5 | - | 4 | " | " | " | |
| | 1211 | Language Course V (Addl. Language II) | 4 | - | 3 | " | " | " | |
| | MM1231.3 | Complementary Course IV | 2 | 2 | 2 | " | " | " | |
| | GL 1221 | Foundation Course II | | | | | | | |
| | | Information technology & methodology in earth science | 4 | - | 3 | " | " | " | |

| | | | | | | | | | |
|-----|-------------------------------------|---|---|---|-----|----|-----|-----|----|
| III | EN 1311 | Language Course VI (English IV) | 5 | - | 4 | '' | '' | '' | 18 |
| | 1311 | Language Course VII Addl. Language III | 5 | - | 4 | '' | '' | '' | |
| | MM1331.3 | Complementary Course V | 5 | - | 4 | '' | '' | '' | |
| | PY 1331.4/CH 1331.2 | Complementary Course VI | 3 | 2 | 3 | '' | '' | '' | |
| | GL 1341 | Core Course III Crystallography | 3 | 2 | 3 | '' | '' | '' | |
| IV | EN 1411 | Language Course VIII (English V) | 5 | - | 4 | '' | '' | '' | 25 |
| | 1411 | Language Course IX Addl. Language IV | 5 | - | 4 | '' | '' | '' | |
| | MM 1431.3 | Complementary Course VII | 5 | - | 4 | '' | '' | '' | |
| | PY 1431.4/CH 1431.2 | Complementary Course VIII | 3 | 2 | 3 4 | '' | '' | '' | |
| | GL 1441 | Core Course IV Mineralogy | 3 | - | 3 | '' | '' | '' | |
| | GL 1442 | Core Course V (Practicals) | | 2 | 3 | | | | |
| V | GL 1541 | Core Course VI Structural Geology | 4 | - | 4 | 3 | 25% | 75% | |
| | GL 1542 | Core course VII Stratigraphy & Paleontology | 3 | - | 3 | '' | '' | '' | |
| | GL 1543 | Core Course VIII Stratigraphy of India | 4 | - | 4 | '' | '' | '' | |
| | GL 1544 | Core Course IX Igneous Petrology | 3 | - | 3 | '' | '' | '' | |
| | | Core Course C (practical) | | 6 | 0 | '' | '' | '' | |
| | GL 1551.1 GL 1551.2 GL 1551.3 | Open Course | 3 | - | 2 | '' | '' | '' | |
| | | Project | 2 | - | 0 | '' | '' | '' | |

| | | | | | | | | | |
|----|-------------------------------------|--|---|---|---|---|---|---|----|
| VI | GL 1641 | Core Course XI Sedimentary Petrology & Metamorphic Petrology | 4 | - | 4 | ” | ” | ” | 25 |
| | GL 1642 | Core Course XII Economic Geology | 4 | - | 4 | | | | |
| | GL 1643 | Core Course XII (Practicals) | 0 | 6 | 4 | | | | |
| | GL 1644 | Core Course XIV (Practicals) | | 5 | 3 | | | | |
| | GL 1661.1 GL 1661.2 GL 1661.3 | Elective Course | 3 | - | 2 | | | | |
| | GL 1645 | Core Course XV (Practicals) | | 0 | 4 | | | | |
| | GL 1646 | Project | 3 | - | 4 | | | | |

OBJECTIVES

The Geology curriculum program is indented primarily to provide expert education for students who wish to pursue professional careers in mineral and oil exploration, extractive industries, environmental science and hydrology, and other areas associated with the Earth Sciences. Being a multidisciplinary integrated nature of modern Earth Sciences, the course utilizes physics, chemistry, biology, mathematics, and computer science to develop a holistic and basic understanding of our planet. In addition, the program has the following specific objectives:

- Educate students regarding the basic methods and philosophy used to conduct scientific research, particularly in the geological sciences.
- Create ability to the students to perform everyday observations and distinguish their observations from their interpretations and to understand that the earth is dynamic and ever changing, and how these observations impact their daily life.
- Create an ability to collect and analyze geologic data and draw conclusions to solve geologic problems in both the lab and the field.
- Impart a sound understanding of the functioning of the lithosphere, hydrosphere, and atmosphere; and how technological advances along with the collection of innumerable observational and analytical data over the last 200 years have lead naturally to the interpretation that the earth originated about 4.6 billion years ago, and that its development has been punctuated by several major planet-wide events that brought about profound change in earth's habitants – an understanding that leads to an appreciation of our dynamic planet and a more knowledgeable perspective of our fragile environment.
- Develop a basic understanding of the most essential natural and physical processes that have shaped the earth throughout its history and continue to shape the planet and the life on it today.
- Create an ability to students to identify minerals and rocks; distinguish the three major rock groups based on their physical characteristics and modes of formation and to understand and interpret how they form and the acquisition of geological data in the fields.
- Generate awareness on the role that lithospheric plates and their movements play in shaping the earth's landmasses and ocean basins, and the internal compositional and mechanical attributes of planet earth.
- Development and understanding and appreciation of geologic time and to evaluate data in the context of major events and trends in the evolutionary history of plants and animals from the fossil record and ability to reconstruct the biological traits of extinct organisms.
- Understanding of the regional geology of Kerala and India and geographic distribution and geological settings, reserves and resources of major earth resources.
- The ability to plan and manage earth resources and understand a range of issues and problems relating to man's exploitation of such resources.
- Impart a good working knowledge of rocks, the physical and chemical characteristics the common minerals in the non-silicate and silicate mineral groups and fossils – their characteristics and importance the role of geology in everyday lives and in the end to the functioning of a modern civilization.
- Create the ability to plan and manage earth resources and understand a range of issues and problems relating to man's exploitation of such resources.

The General course structure of the first degree programme has been tabulated and given in the following pages. Ten theory papers, four practicas, project work & field work form the core course. Field work is an integral academic requirement for all geology students and hence it is compulsory to undertake the same either in the fifth or sixth semester. Out of

the three open courses and three elective courses listed below, the concerned college can choose any one from each category based on the infra structural facilities available in the host department. The elective courses are offered to the students of the same core subject and the open courses are offered to the external students of other core subjects. In addition to these, Department of Geology will be offering four complementary theory courses and one practical course for the Geography core students. Evaluation of field work report will be done along with the structural geology practical exams. A maximum weight of 3 can be given for the same.

SUBJECT : GEOLOGY
CORE, ELECTIVE AND OPEN COURSES

| semester | course type | code | title | hours | credits |
|----------|-------------|-------------------------------|---|-------|---------|
| I | Theory | GL 1141 | General Perspectives of Geology | 72 | 4 |
| II | Theory | GL 1221 | Information Technology and Methodology in Earth Science | 72 | 3 |
| III | Theory | GL 1341 | Crystallography | 54 | 3 |
| | Practical | | Crystallography Practical (Exam will be conducted on IV th Semester) | 36 | 0 |
| IV | Theory | GL 1441 | Mineralogy | 54 | 3 |
| | Practical | GL 1442 | Crystallography and Mineralogy Practical | 36 | 3 |
| V | Theory | GL 1541 | Structural Geology | 72 | 4 |
| | Theory | GL 1542 | Stratigraphy and Palaeontology | 54 | 3 |
| | Theory | GL 1543 | Stratigraphy of India | 72 | 3 |
| | Theory | GL 1544 | Igneous Petrology | 54 | 3 |
| | Practical | | Structural Geology and Stratigraphy Practical (exam will be conducted on VI th semester) | 108 | 0 |
| | PROJECT | | Project Work | 36 | 0 |
| | OPEN | GL1551.1 | Disaster Management | 54 | 2 |
| | | GL1551.2 | Remote Sensing | 54 | 2 |
| GL1551.3 | | Geographic Information System | 54 | 2 | |
| VI | Theory | GL 1641 | Sedimentary Petrology and Metamorphic Petrology | 72 | 4 |
| | Theory | GL 1642 | Economic Geology | 72 | 4 |
| | Practical | GL 1644 | Petrology Practical | 108 | 4 |
| | Practical | GL 1645 | Economic Geology and Palaeontology Practical | 90 | 3 |
| | Practical | GL 1645 | Structural Geology and Stratigraphy Practical | 0 | 4 |
| | PROJECT | GL 1646 | Project work | 54 | 4 |
| | ELECTIVE | GL1661.1 | Groundwater Investigation and Management | 54 | 2 |
| | | GL1661.2 | Geotechnical Engineering | 54 | 2 |
| | | GL1661.3 | Exploration and Mining Geology | 54 | 2 |

GRADING SYSTEM

Both CE and ESE will be carried out using Direct Grading System on a 5 point scale as given below

DIRECT GRADING

| Letter Grade | Performance | Grade Points (G) | Grade Range |
|--------------|---------------|------------------|--------------|
| A | Excellent | 4 | 3.50 to 4.00 |
| B | Very Good | 3 | 2.50 to 3.49 |
| C | Good | 2 | 1.50 to 2.49 |
| D | Average | 1 | 0.50 to 1.49 |
| E | Below Average | 0 | 0.00 to 0.49 |

In direct grading, each descriptive answer is directly given a letter grade in place of marks, on the basis of an assessment of the quality of the answer. In case of objective type questions, grading is undertaken by bunching them into 4. Thus, if all the 4 answers in the bunch are correct, the bunch can be graded as A; if 3 are correct the grade is B; if 2 are correct the grade is C; if 1 is correct the grade is D; if no answer is correct, the grade is E.

Consolidation of Grades

The overall grade for an answer paper (ESE theory) is consolidated by dividing the sum of weighted grade points by the sum of weights, as shown in the example given below.

Consolidation of Grades for an Answer Paper (Theory)

| Question type | Question No. | Grades awarded | Grade points (P) | Weight (W) | Weighted Grade points |
|---|--------------|----------------|------------------|------------|-----------------------|
| Objective 4 bunches – No choice 4 x 1 = 4 | 1-4 | C | 2 | 1 | 2 |
| | 5-8 | B | 3 | 1 | 3 |
| | 9-12 | D | 1 | 1 | 1 |
| | 12-16 | A | 4 | 1 | 4 |
| Short answer (8 out of 12) 8 x 1 = 8 weightage | 17 | A | 4 | 1 | 4 |
| | 18 | D | 1 | 1 | 1 |
| | 19 | C | 2 | 1 | 2 |
| | 20 | B | 3 | 1 | 3 |

| | | | | | |
|---|----|---|---|---|---|
| | 21 | A | 4 | 1 | 4 |
| | 22 | A | 4 | 1 | 4 |
| | 23 | A | 4 | 1 | 4 |
| | 24 | D | 1 | 1 | 1 |
| | 25 | C | 2 | 1 | 2 |
| | 26 | D | 1 | 1 | 1 |
| | 27 | A | 4 | 1 | 4 |
| | 28 | C | 2 | 1 | 2 |
| Short Essay / Paragraph) 5 out of 8 5 x 2 = 10 | 29 | C | 2 | 1 | 2 |
| | 30 | B | 3 | 2 | 6 |
| | 31 | C | 2 | 2 | 4 |
| | 32 | B | 3 | 2 | 6 |
| | 33 | C | 2 | 2 | 4 |
| | 34 | B | 3 | 2 | 6 |
| | 35 | A | 4 | 2 | 8 |
| | 36 | B | 3 | 2 | 6 |

| | | | | | |
|---|---|---|---|----|----|
| Long Essay (2 out of 3) 2 x 4 = 8 | 37 | B | 3 | 2 | 6 |
| | 38 | D | 1 | 4 | 4 |
| | 39 | C | 2 | 4 | 8 |
| Total 30 | | | | 30 | 89 |
| Grade of Answer Paper | Total weighted grade points / Total weights = $89/30 = 2.97 = \text{Grade B}$ | | | | |

The grade of a answer paper (ESE Practical) shall be consolidated by similar procedure discussed above by assigning weights for the various components (eg. Procedure, Experiment, Calculation, Accuracy of the reported values, Presentation of results, Diagrams etc.) The Boards of studies shall define the components and their weights and include them in the scheme and syllabus of each practical course.

The grades for continuous evaluation (CE) shall be consolidated using the same procedure adopted for the ESE grade combining the grades of the internal components, viz. attendance, assignment, seminar and test papers taking into account their weights.

With regards to attendance (weight = 1), the following grading scheme shall be followed; less than 75% E; Above 75% and less than 80%; D; Above 80% and less than 85% C; Above 85% and less than 90%; B; above 90%; A.

Assignments (weight = 1) shall be graded on the basis of their quality. The teacher shall define the expected quality of an assignment in terms of structure, content, presentation etc. and inform the same to the students. Due weight may be given for punctuality in submission. Seminar (weight = 1) shall be similarly graded in terms of structure, content, presentation, interaction etc.

Test papers (weight = 2) shall be graded by the same procedure adopted for End-Semester Evaluation (ESE) of theory course.

If B, C, B and A grades are scored by a student for attendance, assignment, seminar and test paper respectively for a particular course. Then her / his grade for that course shall be consolidated as shown in the example given below;

Consolidation of Grades for CE

| Component | Weight (W) | Grade Awarded | Grade points (G) | Weighted Grade points (W x G) |
|------------|--|---------------|------------------|-------------------------------|
| Attendance | 1 | B | 3 | 3 |
| Assignment | 1 | C | 2 | 2 |
| Seminar | 1 | B | 3 | 3 |
| Test Paper | 2 | A | 4 | 8 |
| Total | 5 | | | 16 |
| CE Grade | Total Weighted Grade points / Total Weights = $16/5 = 3.20 = \text{Grade B}$ | | | |

Consolidation of the Grade of a Course

The grade for a Course is consolidated by combining the ESE and CE grades taking care of their weights. For a particular course, if the grade scored by a student is C and B respectively for the End Semester and Continuous Evaluation, as shown in the above examples, then, the grade for the Course shall be consolidated as shown in the example given below.

| Exam | Weight | Grade Awarded | Grade Points (G) | Weighted Grade Points (W x G) |
|-----------------|---|---------------|------------------|-------------------------------|
| ESE | 3 | C | 2.47 | 7.41 |
| CE | 1 | B | 3.20 | 3.20 |
| Total | 4 | | | 10.61 |
| Grade of Course | Total Weighted Grade points/Total Weights = $10.61/4=2.65$ =Grade B | | | |

D Grade is required for passing a course. There shall be no separate minimum of continuous valuation.

Consolidation of SGPA is obtained by dividing the sum of credit points (P) obtained in a semester by the sum of credits (C) taken in that Semester. After the successful completion of a Semester, Semester Grade Point Average (SGPA) of a student in that Semester shall be calculated. Suppose the student has taken four course each of 4 credits and two courses each of 2 credits in a particular semester. After consolidating the Grade for each course as demonstrated above, SGPA has to be consolidated as shown in the example given below.

| Course code | Title of course | Credits (C) | Grade awarded | Grade Points (G) | Credit points (P = C x G) |
|-------------|---|-------------|---------------|------------------|---------------------------|
| 01 | | 4 | A | 4 | 16 |
| 02 | | 4 | B | 2.65 | 10.60 |
| 03 | | 4 | A | 3.8 | 15.2 |
| 04 | | 4 | C | 2.2 | 8.8 |
| 05 | | 2 | B | 3.2 | 6.4 |
| 06 | | 2 | B | 3.4 | 6.8 |
| Total | | 20 | | | 63.80 |
| SGPA | Total credit points / Total credits = $63.80/20 = 3.19$ | | | | |

For the successful completion of a Semester, a student has to acquire a minimum of 20 credits and score a minimum SGPA of 2.00. However, a student is permitted to move to the next semester respective of his / her SGPA.

Consolidation of CGPA; An overall letter grade (Cumulative Grade) for the whole Programme shall be awarded to the student based on the value of CGPA using a 7-point scale, as given below. It is obtained by dividing the sum of the credit points in all the courses taken by the student for the entire program by the total number of credits.

Consolidation of CGPA

| Semester | SGPA Credit Point (CP) | SGPA Credits (C) | CGPACP/C |
|--|------------------------|------------------|--------------------|
| 1 | 63.80 | 20 | $396.6/120 = 3.30$ |
| 2 | 65.00 | 20 | |
| 3 | 70.00 | 20 | |
| 4 | 69.45 | 20 | |
| 5 | 64.25 | 20 | |
| 6 | 64.10 | 20 | |
| Total | 396.8 | 120 | |
| CGPA = Total Credit points of all semesters divided by Total Credits of all Semesters = $396.6/120=3.30$ = Grade B | | | |

Overall Grade in a Programme

| CGPA | Overall letter Grade |
|---------------|----------------------|
| 3.80 to 4.00 | A ⁺ |
| 3.50 to 3.79 | A |
| 3.00 to 3.49 | B ⁺ |
| 2.50 to 2.99 | B |
| 2.00 to 2.49 | C ⁺ |
| 1.50 to 1.99 | C |
| Less than 1.5 | D |

The grade of the Course taken over and above the minimum prescribed credits, which shall not be counted for computing CGPA.

GUIDELINES FOR PREPARATION AND SUBMISSION OF DISSERTATION/PROJECT IN FDP IN GEOLOGY

PROJECT / DISSERTATION

Project work forms an integral part of the three year degree. It really helps student to get acquaintance with the research methodology and also bringing their talents. Importance should be given for originality of approach. The project is assigned four credits.

The project can be done individually or as a group of maximum 5 students. The project are identified during 5th semester with the guidance of the supervising teacher. Project report (25 to 30 pages) in duplicate shall be submitted to the department by the end of 6th semester before the examination commences. The reports are to be produced before the external examiners appointed by the university for valuation.

EVALUATION OF PROJECT

The valuation of the project can be done as per the scheme detailed below. Each candidate shall be evaluated separately. There can be a maximum of 15 candidates per session with two sessions / day.

Component

Weight

Originality of approach
Relevance of the topic
Genuineness of work / project
Presentation

2
2
4
2

A viva-voce based on the project should be conducted individually. Various components to be consider are given below.

Component

Weight

Knowledge of the subject
Presentation skills

6
4

The grade for the project is consolidated by combining the grades of project and viva, as shown below.

Dissertation / Project
Viva-voce

3 weight
1 weight

Semester I
Code: GL 1141
General Perspectives of Geology
72 Hours 4 Credits

Unit I

Science and Science studies – Types of knowledge: Practical, Theoretical and Scientific knowledge. Information: What is Science; What is not Science; Laws of Science – Basis for scientific laws and factual truths. Science as a human activity. History and development of Earth Sciences. The Solar System- The Planets, Asteroids, Comets and Meteorites. The Earth- its size, shape, volume and density. Views on the age of the earth. Origin of the Earth – Nebular, Planetesimal, Tidal and Cloud hypotheses.

(12 Hrs)

Unit II

External geological processes and agents. Weathering – Agents, Types and products of weathering. Geological classification of Soils; Soil profile. Mass wasting – types.

Volcanoes – Types of Volcanoes, Mechanism and causes of volcanic eruptions. Types of volcanic eruption and products. Wind – Geological action of wind, Landforms of Aeolian origin. Mountains and Isostasy.

(22 Hrs)

Unit III

Drainage basins and patterns. Development of a typical river system. River erosion, Transportation and Deposition. Aggradational and degradational fluvial landforms. Lakes- Origin, Classification and geological importance.

(14 Hrs)

Unit IV

Ground Water- Hydrologic cycle, source, nature and storage, porosity, permeability, aquifers and aquicludes, water table, seepage and springs, geysers, types of wells, artesian wells. Geological action of Ground Water.

Environmental Geology- Definition. Environmental Pollution: problems related to disposal of wastes, mining and water scenario.

(12 Hrs)

UNIT V

Oceans and Seas- Oceanic water- extent and composition, waves, current and tides. Erosion, transportation and deposition. Coastal landforms. Coral reefs – types and distribution.

(12 Hrs)

Semester II

Code: GL 1221

Information Technology & Methodology in Earth Science

72 Hours 3 Credits

Unit I

Introduction of computers. Overview of information Technology- Modern Personal Computers and peripherals- Computer networks and internet. Academic search techniques- Infilbnet, E-learning in Geoscience. Basic Geoinformatics.

(12 Hrs)

Unit II

Basic ideas of the following methodologies in Science – Hypotheses, theories and laws in Science – Observation. Evidences and proofs. Experimentation and data collection – Data interpretation and Deduction.
Field methodologies in Geology. Principles of Geological field work – maps, instruments. Geological data Collection and interpretation.

(14 Hrs)

Unit III

Application and relevance of geological sciences in day today life. Mining, water resources, disaster management, engineering applications.

Use of Clinometer and Brunton compass with practical demonstration. Map symbols. Toposheets. GPS. Aerial photographs and satellite imageries.

(16 Hrs)

Unit IV

Glaciers- formation and morphology. Types of glaciers. Geological work of glaciers and glacial landforms

(12Hrs)

Unit V

Interior of the earth- significance of seismic waves in the study of interior of the earth, seismic discontinuities. Crust, mantle and core.

Earthquakes: Types and propagation of seismic waves, focus and epicenter, theory on the origin of earthquakes, seismograph, scale of intensity and magnitude, process and effects of earthquakes. Seismic belt of the world.

(18 Hrs)

Semester III
Code: GL 1341
Crystallography

54 Hours 3 Credits**Unit I**

Crystalline state and crystals. Morphology of crystals, faces, edges, vertex, forms and zones. Crystal angles- plane angles, interfacial angles and solid angles. Goniometer-contact and reflection type. Law of constancy of interfacial angles. External symmetry. Crystal classes. Axes- choice of axes, labelling and orientation. Crystal systems- Nomenclature of crystal faces, intercepts, parameters. Weiss notation, Miller indices and Miller- Bravais indices. International crystallographic notation – Herman- Maugin symbols.

(12 Hrs)

Unit II

Systematic crystallography: The study of symmetry, simple forms and combination of the following crystal classes.

Isometric System- Normal, tetrahedral, pyritohedral and plagiohedral class.

Tetragonal System- Normal, tripyramidal and sphenoidal.

(15 Hrs)

Unit III

Hexagonal System: a) Hexagonal division - Normal, hemimorphic and trapezohedral
b) Rhombohedral division- Rhombohedral, Rhombohedral hemimorphic and trapezohedral .

Orthorhombic System - Normal

Monoclinic System - Normal

Triclinic System - Normal.

(15 Hrs)

Unit IV

Holohedral, Hemihedral, Tetartohedral, hemimorphic and enantiomorphic forms.
Twin crystals- Elements of twinning, twin plane and composition plane. Important examples of twinning.

(12 Hrs)

Semester IV
Code: GL 1441
Mineralogy

54 Hours 3 Credits**Unit I**

Physical properties of minerals like form, habit, cleavage, fracture, colour, streak, hardness, diaphenity and specific gravity. Thermal, electrical and radioactive properties of minerals. Chemical mineralogy. Geochemical distribution of elements. Types of bonds, ionic radii, ionic ratios, isomorphism, solid solution, exsolution, polymorphism, psuedomorphism, mineraloids and metamict minerals.

(10 Hrs)

Unit II

Optical mineralogy: Polarisation of light, polarization by refraction, absorption and reflection. Double refraction. Construction of nicol prism. Petrological microscope – parts and functions. Mechanical and optical accessories. Birefringence. Isotropic and anisotropic substances, uniaxial and biaxial indicatrices.

Diagnostic optical properties of the following: Olivine, Enstatite, Hypersthene, Augite, Diopside, Hornblende, Actinolite, Tremolite, Anthophyllite, Biotite, Muscovite, Chlorite, Andalusite, Sillimanite, Kyanite, Staurolite, Garnet, Quartz, Orthoclase, Microcline, Perthite, Plagioclase Leucite, Nepheline, Calcite and Apatite.

(12 Hrs)

Unit III

Descriptive Mineralogy : Classification of minerals. Systematic study of the physical and chemical properties of important non-silicate minerals. **Oxides** of calcium, iron, magnesium, titanium, tin, aluminium, zinc; **Carbonates** of Ca, Mg, Sr, Pb, Zn, Fe, Ba; **Sulphates** of Ca, Mg, Sr, Ba, Fe, Zn, Pb; **Sulphides** of Pb, Cu, Zn, Hg, Fe; **Halides** of K, Ca, Na; **Phosphate**- apatite;

(10 Hrs)

Unit IV

Structure, classification, physical properties, optical properties and occurrence of the following families – Olivine, Pyroxene, Amphibole, Feldspars, Mica, Zeolite, Aluminium silicates (kyanite, andalusite and sillimanite) and Garnet.

(12 Hrs)

Unit V

A brief study of the following :

Zircon, Feldspathoids, Clay minerals, Quartz family, Beryl and Tourmaline, Staurolite, Topaz, Cordierite.

(10 Hrs)

Semester V
Code: GL 1541
Structural Geology

72 Hours 4 Credits**Unit 1**

Stratification, Dip, Strike, Apparent dip, Factors controlling pattern and width of outcrops. Outlier and inlier.

Rule of V's, Simple problems involving dip, apparent dip, thickness of beds and width of outcrops.

(12 Hrs)

Unit II

Rock deformation – stress and strain. Stages of rock deformation. Primary and secondary structures.

Foliation and lineation.

(12 Hrs)

Unit III

Folds – Geometry and elements of folded surfaces. Geometric classification of folds. Recognition of folds in field and maps. Stereographic representation of folds.

(12 Hrs)

Unit IV

Faults – Mechanics of faulting, terminology and classification. Criteria for recognition of faults in field and maps.

Joints – Nature, origin and classification.

Unconformities – Types of unconformities and their recognition in the field and in maps.

(22 Hrs)

Unit V

Plate Tectonics- concept of tectonics; isostasy. Continental drift, Seafloor spreading, Palaeomagnetism, Types of plate boundaries, geosynclines.

(14 Hrs)

Semester V**Code: GL 1542****Stratigraphy and Paleontology****54 Hours 3 Credits****Unit I**

Scope and basic principles: Uniformitarianism, Superposition, Lateral continuity, original horizontality, faunal succession, Faunal Assemblage. Local section/strata. Breaks in stratigraphic successions, Hiatus, Unconformities, non-sequences, diastem and their significance.

(6 Hrs)

Unit II

Elements of lithostratigraphic, chronostratigraphic and biostratigraphic classification and their units. A brief study of the modern trends in stratigraphic classification like sequence stratigraphy, type area. Transported and leaked fossils. Geological Time Scale and time units. Ice ages. Stratigraphic concepts of correlation, criteria and methods. Index fossils. Overlap. Offlap.

(14 Hrs)

Unit III

Scope and subdivisions of Paleontology. Conditions and methods of fossilization. Concept of body fossil, Trace fossils, and microfossils. Classification and nomenclature of fossils. Basic principles of taxonomy and systematics. Binomial nomenclature, type specimens and kinds – Holotype, Genotype; Uses of fossils.

A brief study of the following plant fossils of India – Glossopteris, Gangamopteris, Ptilophyllum, Sigillaria, Calamites, Lepidodendron.

(8 Hrs)

Unit IV

Morphological features, Classification and geological history of the following

Phylum: Protozoa – Order Foraminifera

Phylum: Coelenterata – Class Anthozoa

Phylum: Brachiopoda

Phylum: Mollusca – Class Pelecypoda, Class Gastropoda

Class Cephalopoda

(14 Hrs)

Unit V

Phylum Arthropoda – Class Trilobita
 Phylum Echinodermata – Class Echinoidea
 Phylum Hemichordata – Class Graptolithina

(12 Hrs)

Semester V
Code: GL 1543
Stratigraphy of India

72 Hours 4 Credits**Unit I**

Brief study of the physiography of India – Major geological divisions of India – Geological Time scale and its representatives in Indian Stratigraphy – General study of Early Precambrian terrains of India and study of the lithology, classifications, structure, syn-and post tectonic intrusives, organic remains, radiometric age and economic resources of the following:-

Sargur Supergroup, Dharwar Supergroup and associated granites and gneisses. Aravalli Super Group of Rajasthan.

(16 Hrs)

Unit II

General study of the Late Precambrian terrains of India and study of the lithology, classification, structure, associated intrusives, organic remains, radiometric age and economic resources of the following:-

Delhi Supergroup, Cuddapah Supergroup, Vindhyan Supergroup and Kurnool Supergroup.

(14 Hrs)

Unit III

A brief study of the distribution of marine Palaeozoic and Mesozoic successions of India and detailed study of the following:- Palaeozoic and Triassic succession of Spiti region – Jurassic of Spiti and Kutch. Cretaceous of Trichinopoly and Narmada valley. Gondwana Supergroup:- Distribution, lithology, classification, age, structural features, fossils and coal resources.

(16 Hrs)

Unit IV

Deccan Traps and associated sedimentaries, their distribution, lithology, classification, fossils and age. A brief study of the distribution of Cenozoic of Assam ;Cuddalore sandstone formations. Siwalik Supergroup.

(14 Hrs)

Unit V

Stratigraphy of Kerala - Precambrian terrain of Kerala, Tertiaries of Kerala, Karewas,

(12 Hrs)

Semester V
Code: GL 1544
Igneous Petrology

54 Hours 3 Credits**Unit I**

Igneous rocks, origin of magma and parental magma. Crystallisation, crystal-melt equilibrium in silicate melt. Magmatic differentiation. Mingling of magmas.

(7 Hrs)

Unit II Crystallisation of the following binary systems:

1) Albite-Anorthite 2) Forsterite-Silica 3) Diopside-Anorthite

(5 Hrs)

Unit III

Textures and structures of igneous rocks. General classification and nomenclature of igneous rocks. Specific study of the IUGS classification. Types of igneous bodies.

(10 Hrs)

Unit IV

Systematic description and petrogenesis of the following families – Granite, Diorite, Gabbro, Basalt and Rhyolites.

(10 Hrs)

Unit V

Brief study of the Ultramafic and alkaline rocks – Lamprophyres, Kimberlites, Carbonatites, Syenite, Anorthosite.

(10 Hrs)

Unit VI

Petrographic provinces. Brief study of Plate tectonic settings and associated igneous rocks.

(12 Hrs)

Semester VI

Code: GL 1641

Sedimentary Petrology and Metamorphic Petrology

72 Hrs 4 Credits

A. Sedimentary Petrology**Unit I**

Origin, transportation and deposition of sediments. Basin, environment and facies concepts. Provenance. Brief concept about Plate tectonics and sedimentation.

(8 Hrs)

Unit II

Composition and origin of sandstone, shale limestone. Classification of sandstone and limestone.

Structure and texture of sedimentary rocks. Brief concepts about argillaceous, arenaceous and rudaceous sediments.

(16 Hrs)

B. Metamorphic Petrology**Unit I**

Definition of metamorphism. Factors of metamorphism. P-T limits of metamorphism. Agents of metamorphism – Pressure, Temperature, Fluid phase and time. Classification of metamorphic rocks.

(6 Hrs)

Unit II

Concepts of metamorphism: Depth zones, Barrowian zones. Index minerals. Metamorphic facies and grade. Types of metamorphism and their important aspects – Contact, Regional, Cataclastic; Grubenmann's depth zone concept, metamorphic zone concept and index minerals, grade concept.

(12 Hrs)

Unit III

Metamorphic textures and structures. Retrograde metamorphism.

Metamorphic paragenesis. Metasomatism.

Metamorphic differentiation – pneumatolitic and injection metamorphism – anatexis and palingenesis.

(12 Hrs)

Unit IV

Metamorphism of pelitic, calcareous and mafic rocks. Plate tectonic settings – Metamorphism associated with convergent and divergent plate margins. Brief study of the important metamorphic rock types of Kerala.

(10 Hrs)

Unit V

A brief study of the petrography of the following metamorphic rocks : Slate, Phyllite, Quartzite, Schist, Gneiss, Granulite, Khondalite, Leptynite, Charnockite, Eclogite, Amphibolite, Migmatite, Mylonite, Hornfels. (8 Hrs)

Semester VI
Code: GL 1642
Economic Geology
72 Hours 4 Credits

Unit I

Scope of Economic Geology – Ore and gangue minerals, Mineral resources and Reserves. Tenor of ores – Syngenetic and epigenetic deposits – Classification of mineral deposits – Bateman's classification.

(10 Hrs)

Unit II

A brief study on the mode of occurrence, distribution in India and important economic uses of the following: Ores of Aluminium, Chromium, Copper, Gold, Iron, Lead, Zinc, Manganese, Thorium, Uranium and Titanium, origin and distribution of Coal and Petroleum.

(14 Hrs)

Unit III

Mineral resources of Kerala – National Mineral Policy – Strategic and critical minerals – Metallogenic provinces and epochs of Indian mineral deposits:

Minerals used as abrasives, refractory, ceramics and gemstones

(12 Hrs)

Unit IV

Process of formation of mineral deposits: Origin due to Internal Processes -

1. Magmatic deposits.
2. Hydrothermal deposits.
3. Contact metasomatic deposits.
4. Metamorphic deposits.

(16 Hrs)

Unit V

Process of formation of mineral deposits: Origin due to External / Surface Processes -

1. Evaporite deposits.
2. Sedimentary deposits.
3. Deposits of mechanical concentration.
4. Deposits of Residual concentration.
5. Oxidation and Supergene enrichment.
6. Volcanic exhalative deposits.

(20 Hrs)

PRACTICALS
SEMESTER III

Crystallography Practical

Identification and description of the following crystal models in normal classes only.

Isometric system: Galena, garnet, Fluorite, Magnetite, Spinel.

Tetragonal System: Zircon, Cassiterite, Rutile, Octahedrite, Apophyllite, Vesuvianite.

Hexagonal: Beryl, Calcite.

Orthorhombic: Olivine, Topaz, Barite, Sulphur, Staurolite.

Monoclinic: Gypsum, Orthoclase, Augite, Hornblende

Triclinic: Axinite, Albite.

Credits:0**Hours:36**

Classification of normal classes of all systems by studying the symmetry elements.
 Study of simple twin models.
 Galena-Flourite-Pyrite-rutile-calcite-quartz-staurolite-Gypsum-augite-orthoclase-albite.
 Preparation of records.

SEMESTER IV
GL 1442 Crystallography & Mineralogy Practical
36 Hours 3 Credits

Physical Mineralogy.

Rock forming mineral and ore mineral.

Megascopic and microscopic identification of minerals.

Physical properties of mineral.

Form & Habit – colour – diaphenity - streak – cleavage – lustre – fracture – hardness - specific gravity.

Magnetic properties - taste and smell.

Record preparation about physical properties of minerals. Crystallography practicals have been done in the third semester.

MEGASCOPIIC MINERALOGY:

Megascopic identification and description of the following:- Quartz, smoky quartz, milky Quartz, Rosy quartz, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal, Orthoclase, Microcline, Albite, Oligoclase, Enstatite, , Hypersthene, Diopside, Augite, Rhodonite, Wollastonite, Anthophyllite, Tremolite, Actinolite, Hornblende, Olivine, Serpentine, Muscovite, Biotite, Phlogopite, Chlorite, Epidote, Garnet, Olivine, Natrolite, Stilbite, Apophyllite, Talc, Steatite, Andalusite, Kyanite, Sillimanite, Staurolite, Apatite, Beryl, Topaz, Calcite, Dolomite, Tourmaline, Zircon, Fluorite.

MICROSCOPIC MINERALOGY:-

Microscopic identification and Description of the following:- Quartz, Orthoclase, Perthite, Microcline, Plagioclase, Nepheline, Leucite, Enstatite, Hypersthene, Augite, Biotite, Muscovite, Olivine, Garnet, Apatite, Tourmaline, Calcite, Kyanite, Sillimanite, Diopside, Hornblende, Tremolite, Actinoloite.

SEMESTER VI

Code GL 1643

Structural Geology & Stratigraphy Practical

Illustration with the help of neat diagrams of the following:

Attitude of beds, true and apparent dip, strike and dip symbols, rules of 'V', types of folds, faults and unconformities. Maps with suitable sections and geological descriptions.

- Simple horizontal beds – two maps.
- Study of effect of relief on 'V' of outcrops – four maps.
- Simple dipping beds – three maps.
- Simple dipping beds with intrusions – three maps.
- Problems involving bore hole data, thickness, dip and apparent dip – three numbers.
- Simple dipping beds with unconformity – four maps.
- Folded beds – five maps.

- Maps with different types of faults –five numbers.
- Combination of intrusions, unconformity, folds and faults –six maps.
Drawing sections and describing the geology.

Problems:

Problems involving true and apparent dip, true vertical thickness and width of outcrops. Three point problems.

SEMESTER VI**Code: GL 1644: Petrology Practical Examination**

| |
|-------------------|
| |
| Credits:4 |
| Hours: 108 |

Megascopic identification of the following rocks:

Granite, Graphic granite, Pegmatite, Aplite, Granite Porphyry, Syenite, Syenite porphyry, Diorite, Gabbro, Anorthosite, Dunite, Dolerite, Basalt, Rhyolite .

Conglomerate, Breccia, Sandstone, Arkose, Shale, Limestone, Laterite.

Slate, Phyllite, Schist, Gneiss, Quartzite, Marble, Amphibolite, Charnockite, Granulite, Schorl rock, Banded ferruginous quartzite.

Microscopic identification and description of the following rocks:-

Granite, Granite Porphyry, Graphic Granite, Syenite, Nepheline Syenite, Diorite, Gabbro, Anorthosite, Dunite, Peridotite, dolerite, basalt.

Conglomerate, Breccia, sandstone, Arkose, Fossiliferous limestone, Oolitic limestone.

Schist, Gneiss, Quartzites, Charnockites, Amphibolite and Marble.

SEMESTER VI**GL 1645: Economic Geology & Palaeontology Practical Examination****Megascopic identification and description, Indian occurrences and uses of the following ore and industrial Minerals: -**

Sulphides: Realgar, Orpiment, Stibnite, Galena, Sphalerite, Chalcopyrite, Pyrite,

Sulphates: Barite, Celestite, Gypsum,

Oxides: Corundum, Hematite, Ilmenite, Magnetite, Chromite, Pyrolusite, Psilomelane, Bauxite,

Carbonates: Calcite, Dolomite, Magnesite, Aragonite, Azurite, Malachite.

Industrial Minerals: Halite, Fluorite, Monazite, Graphite, Asbestose.

Palaeontology

Megascopic identification, drawing and description of the following fossils:

Anthozoa: Calceola, Zaphrentis, Lithostrotion, Favosites, Halysites, Montlivaltia, Isastrea, Thecosmilia;

Brachiopoda: Spirifer, Productus, Terebratula, Rhynchonella, Lingula

Echinodermata: Cidarid, Hemicidarid, Micraster, Hemiaster,

Lamellibranch: Arca, Cardita, Pecten, Trigonina, Megalodon, Gryphea, Exogyra, Ostrea, Inoceramus, Alectryonia, Hippurites.

Gastropods: Natica, Trochus, Turritella, Conus, Murex, Physa, Bellerophon, Cypraea

Cephalopods: Nautilus, Ceratites, Acanthoceras, Turritites and Belemnites,

Trilobites: Paradoxides, Calymene, Phacops, Olenus, Olenellus.

Graptolites: Phyllograptus, Tetragraptus, Diplograptus, Monograptus,

Plant fossils: Glossopteris, Gangamopteris, Ptilophyllum, Lepidodendron,

Sigillaria, Calamites.

BOOKS FOR STUDY AND REFERENCE

SEMESTER I

Code GL 1141

General perspectives of Geology

BLOOM, A. L (199 Z): Geomorphology, Second Edition, Prentice Hall India Pvt. Ltd., New Delhi.

HOLMES, A. (1989) : Principles of Physical Geology. ELBS, Third Edition.

GILLULY, J. WATERS, A.C. and WOOD FORD, A.O (1975) Principles of Geology, Fourth Edition. W, H, Freeman & Co.

JUDSON, S. and KAUFFMAN. ME. (1990 Physical Geology, Eighth Edition, Prentice Hall, New Jersey.

MCALESTER, A.I . and HAY, E.A. (1975) Physical Geology, Principles and Perspectives. Prentice Hall inc. London.

MCGEARY, D., PLUMMER, C. and CARLSON H. (2004) physical Geology Earth revealed, Fifth Edition, McGraw Hill

MATHUR, Physical Geography. National Book Trust, New Delhi.

MISHRA., Rivers of India. National book, Trust, New Delhi

MONTGOMERY, C.W. (1993) Physical Geology Wn. C. Brown publishers, IOWA

MUKHERJEE,P.K :1984)A Text Book of Geology,World Press

SKINNER, B.J. and PORTER. S.C. (198). Physical Geology, John Wiley and Sons, New York

STRAHLER, AN. 1971) Earth Sciences. Second edition. Harper and Row

STRAHLER, N & 1975) Environmental Geo Sciences Wiley International

SEMESTER II

Code GL 1221 Information Technology & Methodology in Earth Science

1. Burrough & Mc Donnel - Introduction to Geographic Information System.
2. Anji Reddy - Remote Sensing and Geographic Information system.
3. C.P. Lo and A.K.W Yeung (2005). Concepts and Techniques of Geographic Information Systems. Prentice Hall of India.
4. Stephen Wise (2002). GIS Basics. CRC Press.
5. Ahmed El-Rabbany (2002) Introduction to GPS: The Global Positioning System. Artech House, Boston.
6. Paul V. Bolstad (2005) GIS Fundamentals: A First Text on Geographic Information Systems. Eider Press.
7. Tasha Wade and Shelly Sommer (2006) A to Z GIS: An Illustrated Dictionary of Geographic Information Systems ESRI Press.

8. Keith C. Clarke (2007) Getting Started With GIS. Prentice Hall.
9. Shiv N. Pandey - Principles and Applications of Photogeology.

&

Reference books included for the first semester.

SEMESTER III

Code GL 1341 CRYSTALLOGRAPHY

- BABU, S.K. and SINHA, DK. (1987) Practical Manual of Crystal Optics, CBS Publication, Delhi.
- BERRY, L.G., MASON, B and DEITRICH, R V.(985). Mineralogy. CBS Publications, Delhi
- BLACKBURN, W. I. and DENNEN, W.H (1990) Principles of Mineralogy. Universal Book Stall, New Delhi
- DEER, WA., HOWIE, R.A. and ZUSSMAN. (1983) An Introduction to the Rock forming Minerals, ELBS.
- KERR, P.G, (1959) Optical Mineralogy. Mc Graw, Hill
- PHILLIPS, W.R. and GRIFFIN, D.T. (1986) Optical Mineralogy, CBS, Delhi
- READ, H.H. (1984) Rutley's Elements of mineralogy, CBS, Delhi.
- DANA E.S,(1955) Textbook of mineralogy, Asia publishing house, Wiley

SEMESTER IV

Code GL 1441 MINERALOGY

1. Dana, E.S. (1955) - A text book of Mineralogy. Asia publishing House, Wiley.
2. Read, H.H. (1974) - Rutley's elements of Mineralogy - Thomas Murby & Co.
3. Mason B and Berry, L.G. - Elements of Mineralogy. W.H. Freeman & Co.
4. Deer. W.A., Howie. R.A. and Zussman, J. (1966) - An introduction of the Rock forming minerals. Longman.
5. Berry, Mason & Dietrich (2000) - Mineralogy. CBS Publication.
6. Cornelis Klen and Cornelius S. Hurlbut (1985) - Manual of Minerology. John Wiley & Sons.
7. Chakrapani Naidu, P.R.J. - Optical Mineralogy.
8. Philips, W.R. - Mineral Optics- Principles and techniques.
9. Kerr. P.F. - Optical Mineralogy.
10. Winchell. A.N. - Elements of Optical Mineralogy.
11. Battey, M.H. - Mineralogy for students.
12. Bloss Donald Optics Wank Hans-Rudolf, Bulakh Andrei (2004)- Minerals - Their Constitution and Origin, Cambridge
13. Nesse William D. (2008) - Introduction to Mineralogy - Oxford University Press.
14. Nesse Williams D. (2003) - Introduction to Optical Mineralogy - Oxford University Press.
15. Perkins Dexter (2006) - Mineralogy. Pearson Prentice Hall.
16. Perkins Dexter, Henke Kevin R (2007) - Minerals in Thin Section. Pearson Education.

SEMESTER V

Code GL 1541 Structural Geology

- BILLINGS. M.P (1972). Structural Geology. Third Edition Prentice Hall, New Delhi.
- DE SITTER (1964) Structural Geology. Second Edition. Mc Graw Hill Co.

HILLS, S. (1961) Elements of Structural Geology, Asia Publishing House.
 LAHEE, (1987) Field Geology. Sixth Edition Mc Graw Hill Co.

RAGAN, (1973) Structural Geology- An Introduction to Geometric Techniques, Second Edition,
 Wiley.

SAWKINS, J.S., CHASE, C.G HARDY, D.G and RAPP, (S. (1978). The evolving earth, Mc
 Milan Publishing Co., New York

SPENCER, E.W., (1177) Introduction to the Structure of the Earth Second Edition, McGraw
 Hill, International Student Edition

SEMESTER V

Code GL 1542 Stratigraphy and Paleontology

BLACK, R.M. (1988) The Elements of Palaeontology Second Edition. Cambridge University
 Press

DOTT, R.H. and BOTTEN, R.L. (1971), [Evolution of the Earth. Mc.Graw Hill, New York.

DUNBAR, C.O. and ROGERS, J. (1961), Principle of Stratigraphy, Wiley.

KRUMBEIN, W.C and SLOSS, L.D. (1963) Stratigraphy and Sedimentation, Freeman.

MOORE, R.C., LALICKER, C.G. and FISCHER. A.G. ((952) Invertebrate Fossils, Mc Graw
 Hill, New York.

RAUP, D.M. and STANLEY. S.M. (1985) Principles of Palaeontology, Second Edition,
 CBS,
 Delhi.

SHROCK, R.R. (1948) Sequence in Layered rocks, Mc. Graw Hill.

SHROCK, R.R. and TWENHOFEL, W.H. (1953) Principles of invertebrate Palaeontology,
 Second Edition, Mc Graw Hill.

WELLER, J.M. (1959) Stratigraphic Principles and practices, Harper and Row.

WOODS, H. (1961) Palaeontology-Invertebrate Cambridge Press.

SEMESTER V

Code GL 1543 Stratigraphy of India

WADIA D.N, Geology of India,

KRISHNAN, MS. (1982) Geology of India and Burma, Sixth Edn, Higginbothams

KRISHNASWAMY. S. (1972) India's Mineral Resources, Oxford & IBH Publishing Co.,
 New Delhi.

Mineral Resources of Kerala(2005), Ed: ROY CHACKO. P.T. Department of Mining and
 Geology

RAVINDRA KUMAR (1985) Fundamentals of Historical Geology and Stratigraphy of
 India, Wiley Eastern.

SEMESTER V

Code GL 1544 Igneous Petrology

BAYLY B. (1968) Introduction to Petrology, Prentice Hall

EHLERS, E.G., BLATT HARVEY (1997) Petrology: Igneous, Sedimentary and Metamorphic, CBS Publishers, new Delhi.

HUANG, W.T. (1962) Petrology, Mc Graw Hill

HYNDMAN, D.W. 1972) Petrology of igneous and Metamorphic Rocks. Mc Graw Hill.

MACKENZIE, W.S., DONALDSON, C.H. and GULFORD. C (1988) Atlas of igneous rocks and their textures, ELBS Longman.

MOOREHOUSE, W.W. (1959) The study of rocks in thin sections, Harper and brothers, New York

SEMESTER VI

Code GL 1641 Sedimentary Petrology and Metamorphic Petrology

Tyrrel, G.W. - Principles of Petrology. Asia Publishing House.

Huang, W.T. - Petrology. McGraw Hill.

Pettijohn, F. J. - Sedimentary Rocks. Harper & Bros.

Harker, A. - Petrology for Students. Cambridge.

Williams, H, Turner, F. J. & Gilbert, C.M. - Petrography. Freeman.

Folk R. L. - Petrology of Sedimentary rocks.

HARKER, A. (1952) Metamorphism. Mc Graw Hill

GREENSMITH, J. (1989) Petrology of the Sedimentary rocks, Seventh Edn. CBS. publishers, Delhi

MIYASHIRO, A (1983) Metamorphism and Metamorphic Belts, George Allen & Unwin.

Turner, F. J. & Verhoogen, J. - Igneous and Metamorphic Petrology. McGraw Hill

Winter, J. D. - Textbook of Igneous and Metamorphic Petrology. Prentice Hall.

SEMESTER VI

Code: GL1642 Economic Geology

1. Gokhale and Rao - Ore deposits of India.
2. Jensen and Bateman A.M. - Economic Mineral Deposits. John Wiley and sons
3. Krishnaswamy, S. - Indian Mineral Resources.
4. Park and Macdiarmid - Ore deposits. Freeman
5. Umeshwar Prasad- Economic geology. CBS Publishers.
6. Wadia - Minerals of India. CBS Publishers.
7. Anthony M. Evans. Ore Deposits.
8. Soman, K. - Geology of Kerala.
9. SINHA, R.K, (1982) Industrial Minerals. Oxford and IBH Publishing Co
10. KRAUSKOPF, K.E (1967) Introduction Geochemistry, Mc Graw Hill Co

**Open Course
Disaster Management**

Code: GL ~~1552~~ 1551.1

54 Hours 2 Credits

Unit I

Introduction - Hazard and Disaster: Definition and terminologies - Classification.
Concept of Disaster Management- Comprehensive Disaster Management Plan.
Elements of Disaster Management Plan.

(8 Hrs)

Unit II

Natural Disasters - Earth quake, Land Slide, Avalanches, Volcanic eruptions - Their
Case Studies. Heat and Cold waves. Coastal Disasters. Coastal Regulation Zone.
Cyclone. Flood. Drought. Tsunami

(12 Hrs)

Unit III

Environmental Disasters - Dam collapse and mitigation measures. Nuclear disasters,
Chemical Disasters, Biological Disaster. Forest fire and Oil fire.

(12 Hrs)

Unit IV

Climate change : global warming, sea level rise, ozone depletion, carbon sink and
sources – causes and effects.

(10 Hrs)

Unit V

Disaster Management. Prevention, Preparedness and Mitigation; Disaster
Preparedness Plan. Application of Information Technology in Disaster Preparedness.
Applications of GIS in disaster management. Emergency procedures and warning
Systems.

(12 Hrs)

References

- Natural Disasters, David Alexander, UCL Press, London, 1993
Natural hazards, Edward Bryant, Cambridge University Press, 2005
Natural disasters, Patrick L Abbott, McGraw Hill International edition, 2008
Disaster management, Rajib Shaw and Krishnamurthy R.R, University Press india ltd,
Hyderabad.

Open Course

Remote Sensing

Code : GL ~~1553~~ 1551.254 Hours 2 Credits **Unit I**

Concepts and foundations of Remote Sensing, Components of and Ideal remote sensing
system, Electromagnetic spectrum – UV, VIS, NIR, MIR, TIR and Microwave spectrum.
Energy interactions in the atmosphere. Energy interactions with various earth surface features.

(10 Hrs)

Unit II

Reference data – interpretation of remote sensing data, Spectro radiometer. An ideal
and the real remote sensing system. Resolution in Remote Sensing – spatial, spectral,
radiometric and temporal.

(10 Hrs)

Unit III

Aerial photographs – Visual interpretation keys, stereoscopy. Overview of various
kinds and types of remote sensing – Visible, thermal, infrared, microwave and MSS.

(10Hrs)

Unit IV

Indian Remote Sensing Satellites. Various sensors used in IRS satellites and their applications.

Unit V

(10 Hrs)

Applications of remote sensing in Environment, Land use, Hydrology and Forest studies.

(12 Hrs)

References

Remote sensing and geographical information systems(2nd ed), Anji ReddyM, BSP-BS publications,2001

Remote sensing and image interpretation, Lillisand, T.M.&Keifer R.W- Wiley & sons, Newyork,2007

Principles and applications of photogeology, Shiv N.Pandey, Wiley eastern Ltd, NewDelhi,1987

Open Course**Geographic Information System**

Code: GL 1551 '3

54 Hours 2 Credits

Unit I

Characteristics of maps: scale, resolution and types of maps. Co ordinate system, map projection, GCPs and geo-referencing. Global Positioning System: Overview of GPS and its applications.

(8 Hrs)

Unit II

Fundamentals of GIS: basic concepts, spatial data and non spatial data, spatial and temporal changes, components of GIS, hardware and software, data input methods – Scanning and digitizing.

(12 Hrs)

Unit III

Spatial Data: spatial entities – point, line and polygon representation of various spatial features, raster and vector data representation. Non Spatial data; attribute data and examples, designing of attribute tables.

(14 Hrs)

Unit IV

Overview of the application of GIS: groundwater potential zones, temporal changes in land use, urban agglomeration, etc.

(12 Hrs)

Unit V

Newer developments in GIS: Such as Google maps, open street mapping, Web GIS

(8 Hrs)

References

An introduction to geographical information systems(2nd ed)Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, Pearson Edn., NewDelhi,2006

Introduction to geographical information systems, Siddiqui M A., Sharda Pustak Bhawan, Allahabad,2006

GIS—Fundamentals, applications and implementations, Elangovan, New India Publishing Agency, New Delhi, 2005

Groundwater Investigation and Management

(Elective: For geology core)

Code: GL ~~1651~~ 1661.1

54 Hours 2 Credits

Unit I

Hydrological cycle and hydrometeorology. Global distribution of fresh water. Hydrological measurements – precipitation, evaporation, soil moisture, soil infiltration and river flow.

(8 Hrs)

- Unit II**
Zones of aeration and saturation, Water table and potentiometric surfaces, porosity, permeability, aquifer, aquiclude, aquitard, aquifuge, Darcy's law, hydraulic head and ground water flow directions, types of aquifers – confined and unconfined. (8 Hrs)
- Unit III**
Ground water investigation techniques – geophysical exploration methods with special emphasis on electrical resistivity method, well logging, tracer techniques. (13 Hrs)
- Unit IV**
Pumping test and determination of safe yield, water conservation methods – check dams, ponds, sub surface dykes, concept of artificial recharging of ground water. (13 Hrs)
- Unit V**
Hydrogeological provinces of India. Groundwater status in India, Major aquifers and groundwater exploitation in Kerala. (12 hrs.)

References.

- Groundwater Hydrology(2nd ed), David Keith Todd, John Wiley & sons, Singapore,1995.
Principles of Hydrology(3rd ed),Ward R.C.& Robinson M, Mc Graw Hill, London,1990
Groundwater assessment , development and management, Karanth K.R, Tata Mc Graw Hill, New Delhi 2006
Groundwater, Raghunath, H.M, New age international Publishers. New Delhi

Geotechnical Engineering (Elective: For geology core)

Code: ~~GL 1652~~ 1661.2

54 Hours 2 Credits

- Unit I**
Weathering and its significance in civil engineering. Soil genesis, soil profile, geologic and engineering classification of soils. Field identification of soils. Soil mechanics. (8 Hrs)
- Unit II**
Water content in soils, specific gravity of soils, void ratio, porosity, water content determination, specific gravity determination. (open drying method for water content determination and density bottle method for specific gravity determination). Particle size of soils, sieve analysis. Particle size distribution curve and its uses, plasticity of soils, consistency limits, permeability of soils, coefficient of permeability, constant head permeability test. (10 hrs.)
- Unit III**
Effective stress and its importance, consolidation of soils, behaviour of saturated soil under pressure. Consolidation tests. Shear characteristics of soils and triaxial compression tests. Compaction of soils and compaction tests (standard Procter test) soil stabilization. Standard penetration test, pile foundations. Engineering properties of laterites. (10 Hrs)
- Unit IV**
Geological materials used in construction. Building stones, roofing and facing materials, concrete aggregate, road aggregate, gravels and sands, concrete aggregate reaction. Possolanic materials. (12 Hrs)
- Unit V**
Geology for site investigation for dams and reservoirs, tunnels, roads and railways, bridges and buildings, land slides. (14 Hrs)

References

- Geology for engineers(7th ed), Blyth F.G.H AND Freitas M.H-Butterworth—
Heinemann, Oxford,2006
Engineering Geology, Parbin Singh
Principles of engineering geology and geotechnics, Dmitry P Krynine, William R
Judd, Mc Graw Hill, Newyork,1957
Engineering Geology(2nd,ed), Bell.F.G. Butterworth- Heinemann, Oxford,2007

Exploration and Mining Geology
(Elective: For geology core)

Code: GL ~~1653~~ 1661.3

54 Hours 2 Credits

Unit I

Prospecting for economic minerals - stages in mineral exploration -Reconnaissance, Preliminary, Regional and Detailed Explorations - objectives of exploration - Grade, Tonnage, Tenor/Calorific value.

Resources and Reserves - Classification of Reserves, UNFC parameters for reserve classification - Types of mineral deposits and different methods of Reserve estimation. (10 Hrs)

Unit II

Basic principles of geochemical exploration - Background, Threshold and anomalous values, Pathfinders in geochemical prospecting. (8 Hrs)

Unit III

General principles of geophysical prospecting - Basic principles, units adopted and instruments used in the following geophysical methods (i) Electrical Resistivity, (ii) Self Potential, (iii) Magnetic, (iv) Gravity, (v) Seismic. Exploration for mineral fuels - coal, petroleum. (16 Hrs)

Unit IV

Mining of economic minerals - Types of mining - Underground and Opencast methods, Criteria for selection of mining methods-Drilling, Blasting, Mine ventilation, Overburden removal. Definitions of shaft, incline, level, winze, raise, adit, crosscut, gallery, goaf, pit, benches, levels, ore and waste dumps. Rehabilitaion of land after mining-ore beneficiation in mineral industry. (12 Hrs)

Unit V

Mineral resources of the future - Coal Bed Methane - Resources from the sea bed - Deep sea nodules. (8 hrs.)

References:

1. Moon Charles J., Whateley Michael K. G., Evans Anthony M. - Introduction to Mineral Exploration - -Wiley Blackwell.
2. Willard C. Lacy (1983) - Mineral exploration. Hutchinson Ross Pub. Co.
3. Marjoribanks W. (1997) - Geological Methods in Mineral Exploration. Chapman & Hall.
4. Arthur W Rose, Herbert Edwin Hawkes and John Stuart Webb (1979) - Geochemistry in Mineral Exploration. Academic Press.
5. Samir Kumar Das (1999) - Surface Mining Technology. Lovely Prakasham Pub. Dhanbad.
6. Mines Act1952 (amended up to date)
7. Minerals and Metals –Regulation and Development Act (amended up to date).
8. Mineral Conservation and development Rules 1987 (amended up to date)
9. Ramachandra Rao M. B. (1975) - Outlines of Geophysical Prospecting. University of Mysore.
10. Babu D. K. and S. K. Sinha (1999) - Practical Manual of Exploration & Prospecting. CBS Pub.

COMPLEMENTARY COURSE FOR GEOGRAPHY CORE

THEORY

| Semester No. | Name of Paper | Total Hours | Credits |
|--------------|---|-------------|---------|
| I | GL 1131- Physical Geology | 36 | 2 |
| II | GL 1231- Geomorphology & Mineralogy | 36 | 2 |
| III | GL 1331- Petrology & Structural Geology | 54 | 3 |
| IV | GL 1431- Stratigraphy, Palaeontology & Economic Geology | 54 | 3 |

PRACTICAL

| Semester No. | Name of Paper | Total Hours | Credits |
|--------------|---------------|-------------|---------|
| IV | GL1432 | 36 | 4 |

SEMESTER I

GL 1131- Physical Geology

36 Hours 2 Credits

Unit I:

Geology – an introduction. The earth – its dimensions, age, and internal structure. Relative age and absolute age of the earth. Processes in geology – agents, energy, classification. The rock cycle, and the three rock types. Plate tectonics, palaeomagnetism, seafloor spreading. (9 hrs)

Unit II:

Weathering – Physical weathering and chemical weathering. Soils – their formation, types in India, erosion and a typical tropical soil profile. (9 hrs)

Unit III:

Mountains – types. Orogeny. Mass movements – different types and their classification, Causes and effects of landslides. (9 hrs)

Unit IV:

Groundwater and its sources. Sources of ground water. Hydrologic cycle. Subsurface occurrence of groundwater. Aquifers, aquicludes, aquitard, aquifuge – types of aquifers – confined, unconfined and artesian aquifers – springs. Recharge and discharge of groundwater – different types of wells. Geological work of groundwater. (9 hrs)

SEMESTER II

GL 1231- Geomorphology & Mineralogy

36 Hours 2 Credits

Unit I:

Streams – overland flow, channel flow. Types of streams. Drainage basins, patterns. Geological work of streams – erosion, transportation, deposition – types of loads – long profile of stream – graded stream. Concept of base level – fluvial aggradational and degradational landforms. (8 hrs)

Unit II:

Glaciers – types, distribution, geological work – glacial landforms, moraines. Wind – geological action of wind – aeolian landforms

Oceans and seas – geological activity of ocean and sea waves. Sea level changes and their causes. Submarine topography, coral reefs, coastal landforms – marine sediments. (10 hrs)

Unit III:

Volcanoes – mechanism, types, products. Distribution of volcanoes, volcanic landforms.

Earthquakes – causes, types, seismic waves, epicentre, focus, isoseismal lines, intensity and magnitude, seismic belts. Interior of the earth. (8 hrs)

Unit IV:

Minerals and crystals – study of crystals and its significance in mineral identification. Physical properties of minerals – colour, streak, lustre, transparency, fracture, cleavage, hardness, specific gravity, magnetism.

Chemical composition and diagnostic properties of the following minerals:-

Quartz, feldspar, biotite, muscovite, hornblende, calcite, garnet, hematite, gypsum, kyanite, sillimanite, magnetite, chromite, pyrite, chalcopyrite, apatite, actinolite, beryl, magnesite, fluorite, talc, pyrolusite, galena, dolomite, corundum, graphite, sphalerite, diamond, coal, asbestos, monazite, bauxite. (10 hrs)

SEMESTER III**GL 1331- Petrology & Structural Geology****54 Hours 3 Credits****Unit 1:**

Magma – physical and chemical properties, lava and its types. Igneous rocks – texture, mode of occurrence – dykes, sills, laccolith, lopolith, stock, batholith, phacolith. Classification of igneous rocks – megascopic study of igneous rock types – granite, pegmatite, rhyolite, dunite, dolerite, pumice, syenite, gabbro, diorite, basalt. (12 hrs)

Unit 2:

Brief study of sediments and sedimentary rocks. Structural and textural features – field classification. Megascopic study of the following sedimentary rocks – sandstone, shale, limestone, conglomerate, breccia, laterite. Metamorphism – types and factors. Textures of metamorphic rocks. Megascopic study of the following metamorphic rocks – phyllite, slate, schist, gneiss, quartzite, marble, granulite, charnockite, khondalite. (16 hrs)

Unit 3:

Topographical maps and geological maps – their preparation, conventional symbols. Structural features controlling landform development. Outcrops, strike and dip of surfaces, primary and secondary structures, unconformities and their geological significance. Folds, geometrical elements – geometrical classification, brief study of the following – antiform, synform, anticline, syncline, isoclinal fold, recumbent fold, overturned fold, geanticline, geosyncline, anti and synclinoriums. (16 hrs)

Unit 4:

Faults – terminologies, types, study of the following – normal, reverse, strike slip and dip slip faults, horst, graben, rift valley.
Joints – types and geological significance.
Foliation and lineation. (10 hrs)

SEMESTER IV**GL 1431—Stratigraphy, Paleontology & Economic Geology****54 Hours 3 credits****Unit 1:**

Stratigraphy – its content, basic principles, uniformitarianism, superposition, lateral continuity, original horizontality, faunal succession, faunal assemblages. Geological time scale and basic time units – eon, era, period, epoch. Major geological divisions

of India – brief study of the stratigraphy of Kerala – Precambrian, Tertiary and Quaternary formations. (14 hrs)

Unit 2:

Palaeontology – its branches, fossils, types of fossilization, and uses of fossils. General morphological features of typical brachiopod, pelecypod, gastropod and arthropod. (10 hrs)

Unit 3:

Economic geology – ore, gangue and industrial minerals. Brief study of important processes of ore mineral formation. Magmatism, hydrothermal process, volcanism, contact metasomatism, metamorphism, evaporites, residual and mechanical concentration, supergene sulphide enrichment. (14 hrs)

Unit 4:

Mode of occurrence, geographic location in India, and geology of the following mineral deposits.

Iron – Kudremukh, Karnataka

Lead and Zinc – Zawar, Rajasthan

Gold – Kolar, Karnataka

Mica – Nellore, Andhra Pradesh

Manganese – Chindwara, Madhya Pradesh

Copper – Khetri, Rajasthan

Aluminium – Koraput, Orissa

Lignite – Neyveli, Tamil Nadu

Coal – Bokaro, Bihar

Petroleum – Naharkotiya, Assam and Bombay High

(16 hrs)

PRACTICALS

Complementary course**Semester I Practical I**

36 Hours

Zero Credits

Preparation of diagrams of the following – rock cycle, hydrological cycle, subsurface groundwater occurrence, confined, unconfined and artesian aquifers.

Preparation of diagram of typical soil profile

Complementary course**Semester II Practical II**

36Hours

Zero Credits

1. Exercises in identification of salient topographic and drainage features using topographic maps. 1 : 50,000 or 1 : 25,000 Survey of India of toposheets.
2. Megascopic identification of rock forming minerals and ore minerals listed in the theory part of the syllabus.

Complementary course**Semester III Practical III**

36 Hours

Zero Credits

1. Preparation of chart showing classification of igneous, metamorphic and sedimentary rocks.
2. Block diagrams of the following: fold - anticline, syncline, recumbent fold, isoclinal fold. Fault – normal, reverse, dip slip, strike slip, graben, horst. Unconformity – angular, disconformity, non-conformity. Joints, dykes, sills, laccolith, lopolith, batholith, phaccolith.
3. Measurement of slope and distance in topographic maps. Completion of outcrops in contour maps. Determination of strike and dip of formations from maps. Interpretation of geological maps with simple structures (fold, fault, unconformity).

Complementary course GL 1432

Semester IV Practical IV

36 Hours

4 Credits

1. Preparation of chart of geological time scale, mineral map of Kerala, map of India showing locations of important mineral deposits mentioned in the theory syllabus.
2. Geological map of Kerala showing distribution of major stratigraphic units.
3. Diagram of a shell of a typical brachiopod, pelecypod, gastropod (ammonite) and trilobite.
4. Megascopic identification of rocks listed in the theory part of the concerned units.

References:

- Physical Geology: Exploring the Earth. James Stewart Monroe, Reed Wicander 2005 Thomson Brooks/Cole 644 page
- Cliffs Quick Review Physical Geology. Mark J. Crawford 1998 Wiley 258 p
- Earth: An Introduction to Physical Geology. Edward J. Tarbuck, Frederick K. Lutgens, Dennis Tasa 2007 Pearson 720 p
- Umeshwar Prasad 2004 Economic Mineral Deposits.
- Dynamic Earth: An Introduction to Physical Geology. Brian J. Skinner, Stephen C. Porter, Jeffrey Park, Tom Freeman 2006 John Wiley 584 p
- Laboratory Manual for Physical Geology. James H Zumberge, Robert H. Rufford, James L Carter 2006 McGraw-Hill Higher Education 289 p
- How Does Earth Work?: Physical Geology and the Process of Science. Gary Allen Smith, Aurora Pun 2006 Pearson Prentice Hall 641 p
- The Field Guide to Geology. David Lambert 2007 Facts On File, Inc. 304 p
- Geology from Experience: Hands-on Labs and Problems in Physical Geology. E. Kirsten Peters, Larry E. Davis 2000 W. H. Freeman 320 p
- Exercises in Physical Geology. W. Kenneth Hamblin, James D. Howard 2004 Pearson 304 p
- Earth Science: Geology, the Environment, and the Universe. Glencoe 2001 McGraw-Hill 970p
- Cambridge Guide to Minerals, Rocks and Fossils. Arthur Clive Bishop, A. Bishop, Alan Robert Woolley 1999 Cambridge University Press 336 p
- Fossils: A Photographic Field Guide Chris Pellant and Helen Pellant 2007 New Holland Publishers 144 p
- Fossils at a Glance. Clare Milsom, Susan Rigby 2003 Blackwell Publishing 155 p

QUESTION PAPERS

Code GL1131

Complementary Course :

Physical Geology

Semester 1

- I. Answer questions from 1 to 4 in one word. (Weightage of 1 for each question)
 - 1 Age of the earth.
 - 2 Shape of the earth.
 - 3 Innermost layer of the earth.
 - 4 Sea floor spreading hypothesis was postulated by _____.
- II.
 - 5 Metamorphic rock formed from limestone.
 - 6 Type of weathering in which rocks peel off as layers.

- 7 Type of soil seen in the Deccan plateau of India.
- 8 Example of chemical weathering..

III.

- 9 Himalayan mountain range is an example of _____ mountain type.
- 10 Slow downward movement of soil down the steep slopes.
- 11 Mountain building movements are called _____ movements.
- 12 Any water bearing rock formation.

IV.

- 13 Type of soil characteristic of tropical climatic conditions.
- 14 The uppermost portion of the zone of saturation.
- 15 An example of aquifuge.
- 16 Type of weathering seen in limestone terrains.

V Short Answer type questions. Answer any eight (weightage of 1 for each qn:)

- 17 Define endogenous processes.
- 18 What is phreatic water?
- 19 What are the different agents of exogeneous processes on the earth?
- 20 What is rock cycle?
- 21 What is soil erosion?
- 22 What is a spring?
- 23 Define types of groundwater storage.
- 24 What are artesian aquifers.
- 25 Define recharge and discharge in groundwater.
- 26 What are springs.
- 27 Define avalanche.
- 28 Permeability.

VI Short Essay type questions. Answer any five.(weightage of 2 for each qn:)

- 29 Types of aquifers.
- 30 Causes of landslides.
- 31 Soil Profile.
- 32 Palaeomagnetism.
- 33 Sea floor spreading.
- 34 Plate tectonics.
- 35 Classify different mountains.
- 36 Types of wells.

VII Essay type. Answer any two. (weightage of 4 for each qn:)

- 37 Write an essay on the geological action of groundwater.
- 38 Describe weathering and its types.
- 39 Describe the concept of sea floor spreading.

Complementary Course:
Semester 2

Geomorphology and Mineralogy

Code GL1231

I. Answer questions from 1 to 4 in one word. (weightage of one for each qn:)

- 1 Colour of powdered mineral.
- 2 A depositional landform feature formed at the mouth of a river.
- 3 Wind faceted pebbles.
- 4 Arm-chair shaped depressions formed due to glacial erosion.

II.

- 5 Erosional features formed by swirling action of water at the base of waterfalls.

- 6 Marine depositional features connecting land to an island.
- 7 Crater lake formed at the summit of volcanic cones.
- 8 The seismic waves that are propagated longitudinally.

III

- 9 Lines joining points of equal seismic intensity.
- 10 Chemical composition of Calcite.
- 11 The typical mineral showing cherry red streak.
- 12 The science of study of crystals.

IV

- 13 The cut-off lakes formed by stream erosion along meanders.
- 14 Type of glacial deposits which show a long and winding pattern.
- 15 The mineral whose composition is SiO_2 .
- 16 The type of drainage pattern characteristic of the branches of a tree.

V Short Answer type questions. Answer any eight. (weightage of one for each qn:)

- 17 What is long profile of stream?
- 18 What is a lapilli?
- 19 What are the two minerals having composition C?
- 20 What are moraines?
- 21 Define graded stream.
- 22 What is epicentre?
- 23 What is long profile of a stream.?
- 24 Define isoseismal lines.
- 25 Define streak in minerals.
- 26 What are eolian landforms.?
- 27 Define types of load
- 28 Ox-bow lakes.

VI. Short Essay type questions. (Answer any five) (weightage of two)

- 29 Describe coral reefs and their types.
- 30 Describe the interior of the earth.
- 31 What is the concept of base level?
- 32 Describe marine sediments.
- 33 Describe modified mercalli scale.
- 34 What is Mohs scale used for and how?
- 35 Describe the causes of earthquakes.
- 36 Drainage pattern.

VII. Essay type questions . Answer any two .(weightage of four)

- 37 Write an essay on the geological action of wind.
- 38 Describe the different physical properties of minerals.
- 39 Describe the erosional and depositional features of volcanoes.

Complementary Course:
Semester 3

Petrology and Structural Geology
Code GL 1331

- I. Answer questions from 1 to 4 in one word.(Weightage of one).
 - 1 Concordant igneous intrusive bodies.
 - 2 A monominerallic igneous rock.
 - 3 An example of hypabyssal igneous rock.
 - 4 Texture of igneous rocks in which large crystals are embedded in a fine grained matrix.

II

- 5 A sedimentary rock with gravel sized well rounded pebbles.
- 6 An example of arenaceous sedimentary rock.
- 7 Texture shown by a metamorphic rock showing alternating layers of felsic and mafic minerals.
- 8 The metamorphic rock formed from limestone.

III

- 9 The texture characteristic of basalt.
- 10 Sedimentary structure produced due to changes in flow regimes of the depositing medium.
- 11 The typical mineral present in Charnockite.
- 12 An example of a metamorphic rock showing granulose texture.

IV.

- 13 The lines joining points of equal altitude seen in topographical maps.
- 14 The unconformity where the older rock is igneous plutonic.
- 15 The fold type in which the axial plane is horizontal.
- 16 An example of a primary geologic structure.

V Short Answer type questions. Answer any eight. (weightage of one)

17. Define batholith.
18. What is a graben?
19. What are the factors of metamorphism?
20. What is graded bedding?
21. Define strike and dip.
22. What is a synform?
23. Define a pumice stone.
24. What is a recumbent fold?
25. Define a geanticline.
26. What is a rift valley?
27. Define a disconformity.
28. Mural joints

VI Short Essay type questions. Answer any five. (weightage of two)

- 29 Describe the lava types.
- 30 Describe a geosyncline.
- 31 What are the types of metamorphism?
32. Describe briefly conventional symbols in maps.
- 33 What are primary and secondary structures?
- 34 Describe the types and factors of metamorphism.
- 35 What are foliation and lineation?
- 36 Schistosity and gneissosity.

VII. Essay type questions . Answer any two (weightage of four)

- 37 Write an essay on the textures of metamorphic rocks.
- 38 Describe joints with reference to the types and geological significance.
- 39 Write about the classification of igneous rocks.

Complementary Course: Stratigraphy, Paleontology and Economic Geology
Semester 4

Code GL 1431

- I. Answer questions from A to D in one word. (weightage of one)
- 1 Branch of geology dealing with the study of strata with reference to age and relation with other strata.

- 2 The theory of uniformitarianism was formulated by _____.
- 3 Time unit higher in hierarchy to period in the geological time scale.
- 4 The principle of stratigraphy which tells that younger strata are disposed above the older strata.
- II
- 5 The youngest unit of Palaeozoic era in the geologic time scale.
- 6 The oldest group of rocks in the Dharwar craton of South India.
- 7 The formation overlying the Trichinopoly formation in the Cretaceous rocks of Trichinopoly.
- 8 Age of the Warkalli Formation.
- III
- 9 The study of fossil spores and pollen.
- 10 The microfossils important in petroleum exploration.
- 11 The head shield of a trilobite is called _____.
- 12 A sinistrally coiled gastropod.
- IV.
- 13 The relatively non economic part of a mineral deposit.
- 14 Ore mineral of magnesium used as refractory.
- 15 An example of an evaporate deposit.
- 16 The process of formation of black sands of Kerala coast.
- V. Short Answer type questions. Answer any eight. (weightage of one)
17. What is meant by faunal succession?
18. What are the divisions of the Quaternary Era?
- 19 What is petrification?
20. Define hydrothermal process.
- 21 What is the geology of the mica deposits of Nellore?
- 22 Define ore.
- 23 What is palynology?
- 24 Define an index fossil
- 25 What is the synonym for Holocene?
- 26 Define magmatic deposits.
- 27 Define principle of order of superposition.
- 28 Khetri copper deposit
- VI Short Essay type questions. (answer any five) weight 2
29. Define Contact Metasomatism.
30. Describe the principle of Original Horizontality.
31. What are the general morphological features of a Brachiopod?
32. What are the salient features of petroleum deposits of India?
- 33 Describe the requirements for fossilization.
- 34 What are the guiding principles of stratigraphy?
- 35 Describe the occurrences of petroleum in India.
- 36 Types of fossilization.
- VII. Essay type questions. (answer any two) weight 4
- 37 Write an essay on the supergene sulphide enrichment process of ore mineral formation.
- 38 Describe the mode of occurrence, geographic location in India and geology of the Iron and gold deposits.
- 39 Describe the geological time scale.