UNIVERSITY OF KERALA

FIRST DEGREE PROGRAMME IN GEOLOGY

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS)

OUTCOME BASED SCHEME AND SYLLABUS

(2020 ADMISSION ONWARDS)

UNIVERSITY OF KERALA
OUTCOME BASED SYLLABUS AND STRUCTURE OF
FIRST DEGREE PROGRAMME IN GEOLOGY
UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM (CBCSS)
(2020 Admission onwards)

Sl. No.	Course Category		Course Code	Course Title	Instructional Hours/Week		Credits	University Exam Duration (Hours)	Evaluation Marks		Total Credits/ Marks
					L	P			CE	ESE	
FIRST SEMESTER											
1	Language Course I (English I)		EN 1111	English I	5	-	4	3	20	80	18
2	Language Course II (Additional Language I)		1111	Additional Language I	4	-	3	3	20	80	
3	Foundation Course I (English)		EN 1121	Foundation Course (English)	4	-	2	3	20	80	
4	Complementary Course I		MM 1131.3	Mathematics	4	-	3	3	20	80	
5	Complementary Course II	Theory	PY 1131.4 / CH 1131.2	Physics / Chemistry	2	-	2	3	20	80	
		Practical			-	2	-	-	-	-	
6	Core Course I	Theory	GL 1141	General Perspectives of Geology	3	-	4	3	20	80	
		Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	-	1	-	-	-	-	
					22	**3**	**18**		**120**	**480**	**600**
SECOND SEMESTER											
1	Language Course III (English II)		EN 1211	English II	4	-	3	3	20	80	18
2	Language Course IV (English III)		EN 1212	English III	5	-	4	3	20	80	
3	Language Course V (Additional Language II)		1211	Additional Language II	4	-	3	3	20	80	
4	Complementary Course III		MM 1231.3	Mathematics	4	-	3	3	20	80	
5	Complementary Course IV	Theory	PY 1231.4 / CH 1231.2	Physics / Chemistry	2	-	2	3	20	80	
		Practical			-	2	-	-	-	-	
6	Foundation Course II / Core Course II	Theory	GL 1221	Geoinformatics and Geomorphology	3	-	3	-	20	80	
		Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	-	1	-	-	-	-	
					22	**3**	**18**		**120**	**480**	**600**

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Sl. No.	Course Category		Course Code	Course Title	Instructional Hours/Week		Credits	University Exam Duration (Hours)	Evaluation Marks		Total Credits/ Marks
					L	P			CE	ESE	
THIRD SEMESTER											
1	Language Course VI (English IV)		EN 1311	English IV	5	-	4	3	20	80	18
2	Language Course VII (Additional Language III)		1311	Additional Language III	5	-	4	3	20	80	
3	Complementary Course V		MM 1331.3	Mathematics	5	-	4	3	20	80	
4	Complementary Course VI	Theory	PY 1331.4 / CH 1331.2	Physics / Chemistry	3		3	3	20	80	
		Practical			-	2	-	-	-	-	
5	Core Course III	Theory	GL 1341	Crystallography and Physical Mineralogy	3	-	3	3	20	80	
		Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	-	2	-	-	-	-	
					21	**4**	**18**		**100**	**400**	**500**
FOURTH SEMESTER											
1	Language Course VIII (English V)		EN 1411	English V	5	-	4	3	20	80	25
2	Language Course IX (Additional Language IV)		1411	Additional Language IV	5	-	4	3	20	80	
3	Complementary Course VII		MM 1431.3	Mathematics	5	-	4	3	20	80	
4	Complementary Course VIII	Theory	PY 1431.4 / CH 1431.2	Physics / Chemistry	3	-	3	3	20	80	
		Practical			-	2	4	3	20	80	
5	Core Course IV	Theory	GL 1441	Optical, Chemical and Descriptive Mineralogy	3	-	3	3	20	80	
6	Core Course V	Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	-	2	3	3	20	80	
					21	**4**	**25**		**140**	**560**	**700**

UNIVERSITY OF KERALA
OUTCOME BASED SYLLABUS AND STRUCTURE OF
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Sl. No.	Course Category	Course Code	Course Title	Instructional Hours/Week		Credits	University Exam Duration (Hours)	Evaluation Marks		Total Credits/ Marks
				L	P			CE	ESE	
FIFTH SEMESTER										
1	Core Course VI	GL 1541	Igneous Petrology	4	-	4	3	20	80	17
2	Core Course VII	GL 1542	Sedimentary Petrology and Metamorphic Petrology	4	-	4	3	20	80	
3	Core Course VIII	GL 1543	Palaeontology	3	-	4	3	20	80	
4	Core Course IX	GL 1544	Environmental Geology	3	-	3	3	20	80	
5	Core Course XIII Practical	GL 1644	Petrology and Palaeontology	-	6	-	-	-	-	
6	Open Course	GL 1551.1	Disaster Management	3	-	2	3	20	80	
		GL 1551.2	Geosciences and Environment							
		GL 1551.3	Gemmology							
7	PROJECT AND STUDY TOUR /FIELDWORK	GL 1646	Project and Study Tour /Fieldwork	-	2	-	-	-	-	
				17	**8**	**17**		**100**	**400**	**500**
SIXTH SEMESTER										
1	Core Course X	GL 1641	Economic Geology	4	-	4	3	20	80	24
2	Core Course XI	GL 1642	Stratigraphy and Structural Geology	5	-	4	3	20	80	
3	Core Course XII	GL 1643	Stratigraphy of India	5		4	3	20	80	
4	Core Course XIII (Practical)	GL 1644	Petrology and Palaeontology	-	-	3	3	20	80	
5	Core Course XIV (Practical)	GL 1645	Economic Geology and Structural Geology	-	6	3	3	20	80	
6	Elective Course	GL 1661.1	Groundwater Investigation and Management	3	-	2	3	20	80	
		GL 1661.2	Marine Geology							
		GL 1661.3	Engineering Geology							
7	PROJECT AND STUDY TOUR /FIELDWORK	GL 1646	Project and Study Tour /Fieldwork	-	2	4	-	20	80	
				19	**6**	**24**		**140**	**560**	**700**
				Total Credits = 120 Total Marks = 3600						**120/ 3600**

PREFACE

Geology as a Scientific Discipline

Geology is the scientific study of the Earth. Its synonym is Earth Sciences. The subject matter of Geology includes the study of landforms, surface and subsurface processes on the earth, the minerals, rocks, groundwater resources, the interior of the earth, fossils etc. The Earth's materials, structures, processes and life have changed over time and this constitutes an important aspect of Geology. Undergraduate programme in Geology forms the foundation for the advanced studies on Geology that leads to the development of work force called Geologists. Geologists have contributed greatly in helping us understand the history of our planet in the solar system. More knowledge of Earth's history will help us to know and foresee how events and processes of the present day might influence the future. Many natural events such as landslides, earthquakes, floods and volcanic eruptions can be hazardous to people. Geologists play a major role in the study of such natural hazards and their mitigation by preparation of maps of areas vulnerable to natural hazards like earthquakes, landslides, floods, cyclones, etc.; thereby giving inputs into the areas that might be affected by these hazards in the future. These maps are greatly relevant as they can be used to guide the development of communities and determine where hazard protection and insurance is required. Geologists also play a major role in Civil Engineering projects such as construction of dams, reservoirs, tunnels, roads, railways, etc. Today we are very much concerned about global climate change. Many geologists are carrying out research in these aspects and are working to learn about the past climates of the earth and how they have changed with time. The information contributed by such geological research is valuable to understand how our current climate is changing and what the results might be in future. Geologists also contribute greatly to the mining sector in the form of delineation and demarcation of ore minerals, petroleum deposits and coal deposits and thereby helping in the economic growth of the nation.

Geology as a Career

By acquiring greater knowledge in the subject of Geology a very interesting and rewarding career can be built up both in the academic field as well as professional field. Input of Geology starts from the Higher Secondary Level onwards and the minimum training required to acquire a profession in the Geology field is a B.Sc. degree in Geology, though it is M.Sc. (Geology) degree holders who

will be usually engaged by Governmental / Non-governmental agencies as Geologists. Geologists work in a variety of settings and environments. These include: natural resource companies, environmental consulting companies, government agencies, non-profit organizations, colleges and universities, etc. Geology is a field based science and therefore many geologists carry out field work in whatever Geological profession they are placed. Others spend their time in laboratories, classrooms or offices. All geologists prepare reports, do calculations and use computers. Geological Research constituting field work, collection of samples and their analysis is essential for developing career as Geoscientists, University and College Professors, etc. Advanced degrees in the form of Ph.D. will often qualify the geologist for supervisory positions, research assignments or teaching positions at the university level. Most Geology post-graduates with a strong academic background and good grades have easily find employment in the Geological field itself if they are willing to move to a location where work is available. Major career opportunities in India of a post-graduate in Geology include the Geological Survey of India, Oil and Natural Gas Corporation, Indian Space Research Organization, National Centre for Earth Science Studies, Central Ground Water Board, Various Universities and Colleges, Centre for Water Resources Development and Management, National Institute of Hydrology, Remote Sensing Utilization Centers, Land Use and Management Departments, Mud Logging companies, Groundwater Department, Mining and Geology Department etc.

Career after B.Sc. Geology

The graduates in Geology are employable as Geological Assistant/Technical Assistant in various Geological organizations like Mining & Geology and Ground Water Department. Geology Graduates with B.Ed. degree can teach courses at school level or Higher Secondary levels in Earth and Environment related subjects. Geology graduates can join Postgraduate programmes in Geology / Marine Geology / Applied Geology / Geoinfomatics / Hydrogeology / M. Tech. Geology, M.Sc. Tech. in Geology etc. Geology is an interdisciplinary science which offers employment opportunities in scientific studies, exploration of natural resources, Mining and Civil Engineering fields.

OBJECTIVES

The B.Sc. Geology program is indented primarily to provide expert education in undergraduate level for students who wish to pursue higher studies in the subject of Geology for acquiring professional careers in the various fields of Geological Sciences such as Mineral and Oil

Exploration, Rock and Mineral based Industries, Environmental Science and Hydrology, Hydrogeology, Engineering Geology and other areas associated with 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 Earth. In addition, the program has the following specific objectives.

- Educate students with the basic methods and philosophy used to conduct scientific research, particularly in the field of Geological Sciences.
- Create ability in 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 have an impact in their daily life.
- Create an ability in students to collect and analyze geologic data and draw conclusions to solve geologic problems in both lab and field.
- Impart a sound understanding of the functioning of the lithosphere, hydrosphere and atmosphere; and understand how technological advances along with the collection of innumerable observational and analytic data over the last 200 years have led naturally to the interpretation that the Earth originated about 4.6 billion years ago, and that its development has been punctuated by several planet-wide events that brought about profound changes in the Earth's habitants – a 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 in 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 also how to acquire geological data in the field.
- Generate awareness about the role that lithospheric plates and their movements play in shaping the earth's land masses and ocean basin, and the internal compositional and mechanical attributes of planet Earth.

- Development, 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.
- Understand the role played by Geological sciences in the fields of Environment and Engineering.
- Impart a good working knowledge of rocks, the physical and chemical characteristics of the common minerals in the non-silicate and silicate mineral groups; fossils – their characteristics and importance and 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.

Programme Outcomes of B.Sc. Geology

A graduate of B.Sc. Geology programme will be able to:

1. Megascopically identify rocks, minerals and fossils in the field as well as laboratory.
2. Read and interpret geological maps with particular reference to structure and lithology.
3. Design and develop geological map, geological cross section and panel diagrams to understand subsurface geology.
4. Interpret topographical maps.
5. Identify landforms, soil types and their interrelationships.
6. Carryout microscopic identification of rocks and minerals.
7. Assist in site selections for civil engineering constructions.
8. Plan and execute geological field work.
9. Understand natural hazard and its impact on the society.

10. Assess the environmental impacts in a geologic perspective.

11. Develop geological knowledge so as to evolve sustainable living practices.

Geology as a Complementary subject

Geology is a complementary subject to B.Sc. Geography students and the subject facilitates the students in getting a better understanding of the earth and its various processes.

Geology as an Open course

The purpose of these Open Courses offered by the Department of Geology is to provide a general understanding of the earth system for students of other streams, viz., science, arts, humanities and languages.

The general course structure of the first degree programme has been tabulated and given in the following pages. Eleven Core theory papers, One Open Course theory paper, One Elective Course theory paper, three practical papers, project and fieldwork/study tour form the course. Field work is an integral academic requirement for all Geology students and hence it is compulsory to undertake the same in the Fifth semester. Project work should be undertaken in the sixth semester. Field work/Study tour will be given credits along with Project work. Individual study tour report has to be submitted by the students as also the Project Report and these two combined will be assessed in the Practical/Viva-voce examinations at the end of sixth semester. Out of three Open Courses in the Fifth semester and three Elective Courses in Sixth semester 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, the Department of Geology will be offering four Complementary Theory courses and one Practical course for the Geography Core students. Evaluation of Project report and Fieldwork/Study tour report will be done along with the Practical/Viva-voce examinations at the end of sixth semester. A maximum credit of 4 can be given for the same.

PROGRAMME SPECIFIC OUTCOMES (PSO) OF

B.Sc. GEOLOGY PROGRAMME

PSO 1:

Understanding the nature and basic concepts of Physical Geology, Geomorphology, Historical Geology and Structural Geology by studying structures in the geological formations and thereby acquiring skills in Geological field.

PSO 2:

Understanding the various crystal forms, their symmetry aspects, properties and identification of different minerals (both megascopically and microscopically), their economic significance and distribution.

PSO 3:

Understanding the various types of igneous, sedimentary and metamorphic rocks analyzing their mineral content and textures megascopically and microscopically.

PSO 4:

Understanding the various branches of Geology such as Geomorphology, Crystallography, Mineralogy, Petrology, Stratigraphy, Paleontology, Economic Geology, Geology and Stratigraphy of India, Marine Geology, Environmental Geology, Natural and Anthropogenic Hazards and Disaster Management, Geoinformatics with application to Geographic Information System (GIS), Gemmology / Mining processes / Exploration methods / Engineering Geology / Hydrogeology / Groundwater Investigation and Management.

PSO 5:

Planning and carrying out Geological field work by using Survey of India toposheets and standard Geological equipments such as Clinometer, Brunton Compass, Geological hammer, Global Positioning System (GPS), etc.

PSO 6:

Acquiring basic knowledge and skill in Geoscientific methods in the laboratory and field. Develop enhanced skills and attitudes for becoming a better learner, thinker and professional in Geological field and overall to become a better human being.

SUBJECT : GEOLOGY
CORE, OPEN AND ELECTIVE COURSES
PROGRAMMES STRUCTURE AND SCHEME OF EXAMINATIONS
(2020 Admission onwards)

Semester	Course Type	Code	Course Title	Hours/ Week	Total Hours	Credits	Marks		
							CE	ESE	Total
I	Theory	GL 1141	General Perspectives of Geology	3	54	4	20	80	100
	Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	1	18	-	-	-	-
II	Theory	GL 1221	Geoinformatics and Geomorphology	3	54	3	20	80	100
	Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	1	18	-	-	-	-
III	Theory	GL 1341	Crystallography and Physical Mineralogy	3	54	3	20	80	100
	Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	2	36	-	-	-	-
IV	Theory	GL 1441	Optical, Chemical and Descriptive Mineralogy	3	54	3	20	80	100
	Practical	GL 1442	Physical Geology, Geomorphology, Crystallography and Mineralogy	2	36	3	20	80	100
V	Theory	GL 1541	Igneous Petrology	4	72	4	20	80	100
	Theory	GL 1542	Sedimentary Petrology and Metamorphic Petrology	4	72	4	20	80	100
	Theory	GL 1543	Palaeontology	3	54	4	20	80	100
	Theory	GL 1544	Environmental Geology	3	54	3	20	80	100
	Practical	GL 1644	Petrology and Palaeontology	6	108	-	-	-	-
	OPEN COURSE	GL 1551.1	Disaster Management	3	54	2	20	80	100
		GL 1551.2	Geosciences and Environment						
		GL 1551.3	Gemmology						
	PROJECT AND STUDY TOUR /FIELD WORK	GL 1646	Project and Study Tour/Fieldwork	2	36	-	-	-	-
VI	Theory	GL 1641	Economic Geology	4	72	4	20	80	100
	Theory	GL 1642	Stratigraphy and Structural Geology	5	90	4	20	80	100
	Theory	GL 1643	Stratigraphy of India	5	90	4	20	80	100
	Practical	GL 1644	Petrology and Palaeontology	-	-	3	20	80	100
	Practical	GL 1645	Economic Geology and Structural Geology	6	108	3	20	80	100
	ELECTIVE COURSE	GL 1661.1	Groundwater Investigation and Management	3	54	2	20	80	100
		GL 1661.2	Marine Geology						
		GL 1661.3	Engineering Geology						
	PROJECT AND STUDY TOUR /FIELD WORK	GL 1646	Project and Study Tour/Fieldwork	2	36	4	20	80	100
			Total	**68**	**1224**	**57**	**360**	**1440**	**1700**

UNIVERSITY OF KERALA
COMPLEMENTARY COURSE FOR GEOGRAPHY COURSE

THEORY

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

PRACTICAL

Semester No.	Code No. and Name of Paper	Total Hours	Credits
IV	**GL 1432 – Geology Practical**	**36**	**4**

Evaluation and Grading

The Scheme of Evaluation of B.Sc. Geology Programme under Choice Based Credit Semester System (CBCSS) shall contain 2 parts.

1) Continuous Evaluation (CE) or Internal Assessment (IA)
2) End Semester Evaluation (ESE) or External Assessment (EA)

Both CE and ESE will be carried out under Marks Based System. For each course in the semester letter grade, grade point and % of marks are given in 7-point indirect grading system. For each course 20% of the total mark shall be given to the Continuous Evaluation (CE) or Internal Assessment (IA) and 80% marks shall be for End Semester Evaluation (ESE) or External Assessment (EA). End Semester Examination of all the Courses in all Semesters shall be conducted by the University.

The CE and ESE ratio shall be 1:4 for both Theory and Practical Courses. There shall be a maximum of 80 marks for ESE and maximum of 20 marks for CE. For all Courses (Theory and Practical), Grades are given on a 7-point scale based on the total percentage of mark (CE+ESE) as given below.

Criteria for Grading

Percentage of marks	CCPA	Letter Grade
90 and above	9 and above	A+ Outstanding
80 to < 90	8 to <9	A Excellent
70 to <80	7 to <8	B Very Good
60 to < 70	6 to <7	C Good
50 to < 60	5 to <6	D Satisfactory
40 to < 50	4 to <5	E Adequate
Below 40	<4	F Failure

Components of Continuous Evaluation (CE) or Internal Assessment (IA) for Theory Course

The Continuous Evaluation (CE) or Internal Assessment (IA) for Theory Course shall be based on pre-determined transparent system involving Attendance, Assignment/Seminar/Viva and Written Test. Each theory course carries 20 marks for Continuous Evaluation (CE) or Internal Assessment (IA). The following table shows the different components of Continuous Evaluation (CE) or Internal Assessment (IA) of theory courses and corresponding marks.

Continuous Evaluation (CE) or Internal Assessment (IA) of theory courses and corresponding marks: (Max. marks 5)

Component	Marks
Attendance	5
Assignment/Seminar	5
Test Paper	10

1. Attendance of each course will be evaluated as follows:

Attendance less than 75 %	1 Mark
75 % & less than 80%	2 Marks
80% & less than 85%	3 Marks
85% & less than 90%	4 Marks
90% & above	5 Marks

2. Assignments or Seminars: (Max. marks 5)

Assignments/Seminars shall be evaluated on the basis of their quality in terms of structure, content and presentation. Seminar shall be similarly evaluated in terms of structure, content, presentation, interaction etc.

3. Tests: (Max. marks 10)

For each Course there shall be one class test during a semester.

The following table illustrates how marks are consolidated for Continuous Evaluation (CE) or Internal Assessment (IA) of theory courses.

Reg. No.	Name of candidate	Attendance (5 Marks)	Assignment/Seminar (5 Marks)	Test Paper (10 Marks)	Total (20 Marks)

Components of Continuous Evaluation (CE) or Internal Assessment (IA) for Practical Course

The Continuous Evaluation (CE) or Internal Assessment (IA) for Practical Courses I, II and III will be based on Attendance, Lab involvement and Records and Test paper.

The following table shows the different components of Continuous Evaluation (CE) or Internal Assessment (IA) and corresponding marks for Practical Course.

Component	**Marks**
Attendance	5
Lab involvement and Records	10
Test Paper	5

Lab Involvement and Records: Lab involvement is to be assessed during the practical classes by the teacher in charge. Quality of Lab Records to be assessed by the teacher concerned on the basis of quality of observation books and lab records. Records must be properly certified by the teacher(s) and Head of the Department.

Practical Test papers: This shall be conducted by teachers-in-charge and marks shall be given based on the student's performance.

The following table illustrates how marks are consolidated for Continuous Evaluation (CE) or Internal Assessment (IA) of practical courses.

Reg. No.	Name of candidate	Attendance (5 Marks)	Lab involvement and Records (10 Marks)	Test Paper (5 Marks)	Total (20 Marks)

Components of Continuous Evaluation (CE) or Internal Assessment (IA) for Project and Study Tour/Fieldwork

Study Tour/Fieldwork is an integral part of B.Sc. Programme in Geology. Study tour must be conducted under the supervision of teachers for understanding rocks, minerals, fossils, rock structures in the field. During this the students must visit at least one mine or quarry or a Geological institute and the studies must be documented in a comprehensive Tour Report under the supervision and guidance of the teacher in charge. Necessary sketches, maps, photographs have to be incorporated in the report.

Samples of rocks, minerals, fossils, etc. have to be collected during the field work. They have to properly labeled and displayed. The concerned teacher shall give marks for Continuous Evaluation (CE) or Internal Assessment (IA) of study tour/fieldwork.

Continuous Evaluation (CE) or Internal Assessment (IA) for Project work shall involve the assessment of the punctuality, use of data, scheme/organization of report. The Continuous Evaluation (CE) or Internal Assessment (IA) for Project and Study Tour/Fieldwork shall be combined as per the table given below.

Reg. No.	Name of candidate	Project Report (10 marks)	Study Tour report (5 Marks)	Specimen Collection (5 Marks)	Total (20 Marks)

First Semester B.Sc. Geology
Core Course – I

Semester	Hours/Week	Hours /Semester	Exam	Marks			Credits
				Internal	External	Total	
I	3 Hours	54 Hours	3 Hours	20	80	100	4

GL 1141: GENERAL PERSPECTIVES OF GEOLOGY

COURSE OUTCOMES

CO 1: Understand the significance of various branches of Geology, the concept of rock cycle; describe characteristics of earth and its origin in relation to the Solar System and the Geological Time Scale.

CO 2: Understand and explain endogenic processes, the theories and hypothesis of plate tectonics, Continental drift and Sea-floor spreading; ideas of plate boundaries, plate movements and associated geological features.

CO 3: Understand and explain Mountains and types, volcanoes, their classification, products and global distribution; and earthquakes, types, causes, effects; elastic rebound theory, seismic waves, scale of measures and seismic belts of world.

CO 4: Understand the various field methods in Geology, the principles and accessories.

SYLLABUS

GL 1141: GENERAL PERSPECTIVES OF GEOLOGY

Unit–I Geosciences - introduction to various branches - Physical Geology, Geomorphology, Mineralogy, Structural Geology, Petrology, Global tectonics, Palaeontology, Stratigraphy, Engineering Geology, Marine Geology, Geochemistry, Applied Geophysics, Geochemistry, Hydrogeology, Meteorology, Oceanography, Remote Sensing, Environmental Geology, Disaster Management and Economic Geology. The concept of rock cycle. **(6 Hours)**

Unit–II Solar system, Planets, Theories of origin of Earth. Earth - Shape, size, age and rotation. Internal structure of earth; crust, mantle, core; density and chemical composition; major seismic discontinuities. Geological Time Scale. **(10 Hours)**

Unit–III Endogenic processes: Plate Tectonics. Continental drift hypothesis and Sea floor spreading- evidences. Lithospheric plates, types of plate boundaries, plate movements and associated geological features, mid-ocean ridges, rift valleys, trenches, transform faults, island arcs, volcanic arcs, Benioff zones, Mantle plumes, Aseismic ridges. Mountains - Types and origin; Isostasy. **(12 Hours)**

Unit–IV Volcanoes and their classification. Volcanic eruption - Types, Products and effects. Global distribution of volcanoes. **(8 Hours)**

Unit–V Earthquakes - types and causes, propagation of seismic waves, focus and epicenter, elastic rebound theory, seismograph and seismogram. Intensity and magnitude of earthquakes, effect of earthquakes, seismic belts of the world, Earthquake hazard zonation of India. **(10 Hours)**

Unit–VI Field methodologies in Geology, Principles – Maps – Instruments – Clinometer, Brunton compass, Map Symbols, Toposheets, GPS, Aerial Photographs, Satellite imageries. **(8 Hours)**

References

1. Arthur Holmes, Principles of Physical Geology (Edinburgh: Thomas Nelson and Sons, 1944 and New York: Ronald Press, 1945.
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5. Press and Siever, Understanding Earth, W. H. Freeman; 4 edition, 2003
6. Ernst W. G., Earth Systems: Processes and Issues, Cambridge University Press, 2000.
7. Frederick K. Lutgens, Essentials of Geology (11th Edition) Pearson Prentice Hall, Pearson Education, Inc. New Jersey, 2012.

First Semester B.Sc. Geology
Syllabus of Core Course – V (Practical)

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
I	1 Hour	18 Hours	Exam in IV Sem.	--	--	--	-

(Note: Practical sessions in First semester; Practical examination in Second semester)

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

COURSE OUTCOMES

CO 1: Understand the applications of geological field instruments, toposheets and maps.
CO 2: Determine slope of terrain, latitude and longitude, distance between places in toposheets; and epicenter of earthquakes.

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

Part A: PHYSICAL GEOLOGY

Clinometer and Brunton Compass - Map orientation, Elements of Map Reading, Fore bearing and Back bearing.

Topographic Sheets: Scale, Legends - Types and Categories, Interpretation of contours and Identification of Natural Landscape Elements, Scale Measurements, Slope Calculation. Determination of Latitude and Longitude from Toposheets. Measurement of distance between Two Points.

Determination of Epicentre of an Earthquake.

Second Semester B.Sc. Geology
Syllabus of Core Course – II

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
II	3 Hours	54 Hours	3 hours	20	80	100	3

GL 1221: GEOINFORMATICS AND GEOMORPHOLOGY

COURSE OUTCOMES

CO 1: Understand the basic aspects of Photogeology and Remote Sensing in relation to electromagnetic spectrum; fundamentals of GIS and applications of remote sensing and GIS in the field of geosciences.

CO 2: Understand and explain exogenic processes, with emphasis on weathering, soils and mass wasting.

CO 3: Understand and describe the different geological agents, viz., streams, groundwater, oceans, glaciers, wind and lakes.

CO 4: Understand and illustrate the geological actions of the various geological agents and their associated landform features.

SYLLABUS

GL 1221: GEOINFORMATICS AND GEOMORPHOLOGY

Unit–I Elementary idea about Photogeology: electro-magnetic spectrum, types, scale and geometry of aerial photographs; Fundamentals of Remote Sensing, Introduction to Geographic Information System (GIS); components of GIS; applications of remote sensing and GIS in geosciences. **(10 Hours)**

Unit–II Exogenic Processes: Weathering – factors, types and products of weathering. Physical and chemical processes. Soil, factors affecting soil formation and soil profile. Laterite. Mass wasting - types, causes and control. **(8 Hours)**

Unit–III Geological agents. Cycle of erosion. Streams – Stream as a geological agent. Drainage basin and drainage pattern. Stream erosion, transportation and deposition. Development and evolution of fluvial landforms - different stages of fluvial evolution - youth, mature and old age stages. **(8 Hours)**

Unit–IV Hydrologic cycle. Origin and occurrence of groundwater. Water table, types of aquifers. Groundwater as a geological agent - erosional and depositional features. Karst topography, stalagmite, stalactite, caves. **(6 Hours)**

Unit–V Oceans – salinity of ocean water. Waves, currents and tides. Coastal erosion, transportation and deposition. Classification of coastlines and coastal morphology. Eustatic sea level changes. Physiographic features of ocean floor: continental shelf, continental slope, continental rise, submarine canyons, abyssal plains, MORs, deep sea trenches, guyots, seamounts. Coral reefs - Types, Their formation and distribution. **(10 Hours)**

Unit–VI Glaciers – Formation, movement and morphology. Types of glaciers. Erosion, transportation and deposition by glaciers. Glacial landforms. Global warming and its effects on glaciers. Wind – Geological action of winds. Landforms of Aeolian origin. Lakes – Origin, Classification, geologic significance**.** **(12 Hours)**

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11. Arthur Holmes (1977) Principles of Physical Geology (Edinburgh: Thomas Nelson and Sons, 1944 and New York: Ronald Press, 1945.
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Second Semester B.Sc. Geology
Syllabus of Core Course – V (Practical)

Semester	Hours/Week	Hours /Semester	Exam in	Mark			Credits
				Internal	External	Total	
II	1 Hour	18 Hours	IV Sem.	--	--	--	-

(Note: Practical sessions in Second semester; Practical examination in Fourth semester)

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

COURSE OUTCOMES

CO 1: Identify drainage patterns and landforms and delineate drainage basins in toposheets; illustrate hydrological cycle, drainage networks, stream meanders and ox-bow lakes and dune types.

CO 2: Prepare thematic maps from toposheets and carry out morphometric analysis of simple drainage basins.

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

Part B: GEOMORPHOLOGY

Study of toposheets to identify different drainage pattern and its illustration.

Delineation of drainage basins and identification of stream order in toposheets and their illustration.

Identification and representation of different landforms in toposheets.

Diagrammatic representation of evolution of meandering stream, hydrologic cycle, drainage network and sand dunes.

Preparation of thematic maps (drainage, contour, landuse, landforms, slope) from toposheets. Morphometric analysis of drainage basins - stream ordering, drainage frequency, drainage density, bifurcation ratio and relief ratio.

Preparation of profile from contour maps and toposheets.

Third Semester B.Sc. Geology
Syllabus of Core Course – III

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
III	3 Hours	54 Hours	3 hours	20	80	100	3

GL 1341: CRYSTALLOGRAPHY AND PHYSICAL MINERALOGY

COURSE OUTCOMES

CO 1: Understand the elements of crystallography, the morphology and symmetry elements of crystals, the laws of crystallography, working principle of Goniometer; describe the classification of crystals into systems and classes, explain crystal notations and indices and the types of crystal forms.

CO 2: Understand and describe the symmetry, simple forms and combinations of the different crystal classes of the six crystal systems.

CO 3: Understand and explain the various aspects of twinning and imperfections in crystals such as the elements of twinning, the twin laws, and acquire basic knowledge of types of crystallographic projections and application of Wulff net.

CO 4: Understand basic ideas of Mineralogy regarding its scope and aim; and describe the important physical properties of minerals.

SYLLABUS

GL 1341: CRYSTALLOGRAPHY AND PHYSICAL MINERALOGY

Unit–I Significance of crystallography in mineralogy. Elements of crystallography: 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, Law of Constancy of Interfacial Angles. External symmetry elements in crystals. Crystallographic axes: choice of axes, labeling and orientation.

(8 Hours)

Unit–II Classification of crystals into systems and classes. Nomenclature of crystal faces: intercepts, parameters, unit face, Weiss notation, Miller indices. Law of crystal indices, axial ratio. Brief study of holohedral, hemihedral, hemimorphic and enantiomorphic forms. **(8 Hours)**

Unit–III Systematic crystallography: The study of symmetry, simple forms and combinations of the following crystal classes.

1. Isometric system – Normal, Tetrahedral, Pyritohedral and Plagiohedral classes.
2. Tetragonal system – Normal, Tripyramidal and Sphenoidal classes

(10 Hours)

Unit–IV Systematic crystallography: The study of symmetry, simple forms and combinations of the following crystal classes.

3. Hexagonal system – Hexagonal Division: Normal, Hemimorphic, Trapezohedral classes. Rhombohedral Division: Rhombohedral, Hemimorphic and Trapezohedral classes.
4. Orthorhombic system – Normal, Hemimorphic and Sphenoidal classes.

(10 Hours)

Unit–V Systematic crystallography: The study of symmetry, simple forms and combinations of the following crystal classes.

5. Monoclinic system – Normal class. 6. Triclinic system – Normal class.

Twinning in crystals - Twin laws, elements of twinning, twin axis, twin plane, composition plane and important examples of twinning. Brief study of morphological imperfections in crystals. Basic concepts of spherical and stereographic projections in crystallography, Wulff net**.** **(8 Hours)**

Unit–VI Mineral - definition of Mineral and Mineraloid, scope and aim of Mineralogy. Physical mineralogy: physical properties of minerals - form, habit, cleavage, fracture, color, diaphaneity, luminescence, fluorescence, phosphorescence, play of colours, luster, streak, hardness, specific gravity. Electrical, magnetic and radioactive properties of minerals. **(10 Hours)**

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2. Phillips, F.C. (1956) An Introduction to Crystallography. Longmans Green.
3. Read, H.H. (1984) Rutley's Elements of Mineralogy. C.B.S. Publishers.
4. Mason, B. and L.G. Berry (1968) Elements of Mineralogy. W. H. Freeman & Co.
5. Klein, C. and C.S. Hurlbut (1993) Manual of Mineralogy. John Wiley, New York.
6. Deer, W.A., Howie, R.A. and J. Zussman (1983) An introduction to the Rock forming minerals. Longman.
7. Kerr, P.F. (1977) Optical Mineralogy. McGraw Hill Book Company, New York.
8. Perkins Dexter (2015) Mineralogy. Pearson Education.

Third Semester B.Sc. Geology
Syllabus of Core Course – V (Practical)

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
III	2 Hours	36 Hours	Exam in IV Sem.	--	--	--	-

(Note: Practical sessions in Third semester; Practical examination in Fourth semester)

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

COURSE OUTCOMES

CO 1: Describe and illustrate the symmetry elements and identify and describe the crystal models of Normal classes of the six crystal systems.

CO 2: Determine and explain the various physical properties of minerals.

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

Part C: CRYSTALLOGRAPHY AND PHYSICAL MINERALOGY

I. Drawing of symmetry elements of normal classes of all systems.

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

- Isometric system: Galena, Garnet, Spinel, Magnetite, Fluorite, Sphalerite, Tetrahedrite, Pyrite and Cuprite.
- Tetragonal system: Zircon, Cassiterite, Rutile, Octahedrite, Apophyllite, Vesuvianite.
- Hexagonal system: Beryl, Calcite
- Orthorhombic system: Olivine, Topaz, Barite, Sulphur, Staurolite
- Monoclinic system: Gypsum, Orthoclase, Augite, Hornblende
- Triclinic system: Axinite, Albite, Kyanite

III. Determination of physical properties of minerals - form, habit, cleavage, fracture, color, luster, streak, hardness and specific gravity.

Fourth Semester B.Sc. Geology
Syllabus of Core Course – IV

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
IV	3 Hours	54 Hours	3 hours	20	80	100	3

GL 1441: OPTICAL, CHEMICAL AND DESCRIPTIVE MINERALOGY

COURSE OUTCOMES

CO 1: Understand the basic concepts and principles of Optical Mineralogy; describe the parts and uses of Petrological microscope and optical accessories and explain pleochroism, birefringence and indicatrix.

CO 2: Understand the ideas of Chemical Mineralogy and explain bonds in minerals; morphological characters of minerals and solid solution and exsolution in minerals.

CO 3: Understand and describe classification of minerals and silicate structures.

CO 4: Understand and explain systematically the physical, chemical and optical properties of silicate and non-silicate minerals.

SYLLABUS

GL 1441: OPTICAL, CHEMICAL AND DESCRIPTIVE MINERALOGY

Unit–I **Optical Mineralogy**: Ordinary and polarized light, polarization of light, refractive index, critical angle and total internal reflection. Polarization by reflection, absorption, refraction. Double refraction, construction of Nicol prism. Isotropic and anisotropic substances. Petrological microscope - parts and functions. Optical accessories - mica plate, gypsum plate and quartz wedge. Birefringence, uniaxial and biaxial minerals, optic sign, relief, pleochroism, interference colour and its order, extinction. Basic description of indicatrix. **(12 Hours)**

Unit–II **Chemical Mineralogy**: Types of Bonds, ionic radii, ionic ratios, Polymorphism, isomorphism, pseudomorphism, solid solution and exsolution in minerals.

(8 Hours)

Unit–III **Descriptive Mineralogy**: Classification of minerals. Rock forming and ore forming minerals. Silicates - Structure and classification of silicate minerals. **(8 Hours)**

Unit–IV Physical, chemical and optical properties of the following: olivines, garnets, pyroxenes amphiboles, micas, feldspars, feldspathoids, quartz. **(8 Hours)**

Unit–V Systematic study of andalusite, sillimanite, kyanite, epidote family, beryl, cordierite, tourmaline, clay minerals, zeolite group. **(8 Hours)**

Unit–VI Systematic study of the important non-silicate minerals - calcite, dolomite. diamond, graphite, sulphur, gold, silver, copper, realgar, orpiment, stibnite, molybdenite, cinnabar, sphalerite, galena, chalcopyrite, pyrite, magnetite, hematite, marcasite, barite, gypsum, halite, flourite, corundum, cuprite, chromite, rutile, cassiterite, ilmenite, monazite, psilomelane, pyrolusite, goethite, limonite, bauxite, aragonite, magnesite, malachite and azurite. **(10 Hours)**

References

1. Dana, E. S. (1955) A Textbook of Mineralogy. Asia Publishing House, Wiley.
2. Read, H. H. (1984) Rutley's elements of Mineralogy. CBS Publishers, Delhi.
3. Mason, B. and L.G. Berry (1968) Elements of Mineralogy. W. H. Freeman & Co.
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Fourth Semester B.Sc. Geology

Syllabus of Core Course – V (Practical)

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
IV	2 Hours	36 Hours	3 hrs	20	80	100	4

(Note: Practical sessions in Fourth semester; Practical examination by combining practicals of First, Second, Third and Fourth semesters)

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

COURSE OUTCOMES

CO 1: Describe the megascopic properties of minerals and identify different minerals.

CO 2: Determine and describe the various optical properties of important minerals under the microscope.

GL 1442: PHYSICAL GEOLOGY, GEOMORPHOLOGY, CRYSTALLOGRAPHY AND MINERALOGY

Part D: MINERALOGY

Megascopic study and identification of following minerals:

Quartz, smoky quartz, milky quartz, amethyst, chalcedony, agate, jasper, chert, opal, orthoclase, microcline, plagioclase, perthite, nephelene, leucite, enstatite, bronzite, hypersthene, diopside, augite, wollastonite, anthophyllite, tremolite, actinolite, hornblende, olivine, serpentine, muscovite, biotite, vermiculite, phlogopite, chlorite, epidote, garnet, natrolite, stilbite, apophyllite, talc, gypsum, apatite, steatite, andalusite, kyanite, sillimanite, staourolite, cordierite, apatite, beryl, topaz, calcite, dolomite, tourmaline, zircon, fluorite, magnetite, heamatite, chromite, sphalerite, psilomelane, pyrolusite, graphite, corundum.

Microscopic study of following minerals:

Quartz, microcline, orthoclase, albite, oligoclase, labradorite, nepheline, leucite, enstatite, hypersthene, augite, diopside, hornblende, tremolite, actinolite, anthophyllite, biotite, muscovite, olivine, epidote, garnet, chlorite, cordierite, andalusite, sillimanite, kyanite, staurolite, calcite, apatite, zircon, tourmaline.

Fifth Semester B.Sc. Geology
Syllabus of Core Course –VI

Semester	Hours/Week	Hours /Semester	Exam	Marks			Credits
				Internal	External	Total	
V	4 Hours	72 Hours	3 hours	20	80	100	4

GL 1541: IGNEOUS PETROLOGY

COURSE OUTCOMES

CO 1: Understand the basic concept of rock cycle, origin of igneous rocks from magma, the Bowen's reaction series; explain the important binary systems, the petrotectonic settings and diversity of igneous rocks in relation to various processes.

CO 2: Understand, classify and explain the forms of intrusive and extrusive igneous rocks and the different igneous structures and textures.

CO 3: Understand, classify and describe the different modes of classification of igneous rocks and explain CIPW norm and normative minerals.

CO 4: Understand and explain systematically the texture, mineralogy, classification, occurrence and origin of granites and basalts; and describe the brief petrographic character of common igneous rocks.

SYLLABUS

GL 1541: IGNEOUS PETROLOGY

Unit–I Rock - definition, types, rock cycle, plutonic, hypabyssal and volcanic igneous rocks. Origin of magma; primary and parental magmas. Cooling history of igneous rocks, melting and crystallization. Bowen's reaction series. Study of following binary systems: Diopside-Anorthite (Eutectic), Albite-anorthite (solid solution), Forsterite-silica (Incongruent)**.** **(10 Hours)**

Unit–II Petrotectonic settings, partial melting and magma generation (mid oceanic ridges and

subduction zones only), Diversity of igneous rocks - magmatic differentiation process, fractional crystallization, liquid immiscibility and assimilation / contamination**.**

(10 Hours)

Unit–III Forms of Intrusive igneous rocks: Concordant forms - sill, laccolith, lopolith and phaccolith. Discordant forms - dykes, cone sheets, volcanic neck, ring dyke, batholiths, stocks, bosses and bysmaliths. Forms of extrusive igneous rocks: lava flows, pyroclastic deposits - agglomerate, lapilli, volcanic ash and pumice**.**

(12 Hours)

Unit–IV Igneous structures: Vesicular and amygdaloidal structures, blocky lava, ropy lava, pillow structure, flow structure, sheet joints, mural jointing, and columnar jointing. Textures: definition and description; Crystallinity – crystallites, microlites, devitrification; Granularity- absolute and relative grain size; Shapes of crystals; Mutual relations – Equigranular textures: allotriomorphic, hypidiomorphic, Panidiomorphic, Inequigranular textures: porphyritic and poikilitic textures, Intergrowth texture – perthite, antiperthite, graphic, vermicular textures, Overgrowth textures - orbicular structure, Reaction textures – coronas, Directive textures – trachytic texture, spherulitic structure and perlitic fracture. **(14 Hours)**

Unit–V Classification: basis of classification – texture, mineralogy and chemistry. Classification based on mineralogy – felsic and mafic minerals, mode, colour index and IUGS classification - QAP classification of plutonic and volcanic rocks and ultramafic rock classification. Chemical classification – Based on silica saturation and based on alkali & silica (brief introduction of alkalic, subalkalic, calc-alkalic and tholeiitic groups only) – Total alkali vs silica classification for volcanic rocks. A short account of CIPW norm and normative minerals. **(14 Hours)**

Unit–VI Texture, mineralogy, classification, occurrence and origin of granites and basalts. Brief petrographic character of common igneous rocks - syenite, diorite, gabbro, andesite, rhyolite, pegmatites, lamprophyres, carbonatite, dunite, peridotite, anorthosite and kimberlite. **(12 Hours)**

References

1. Tyrrell, G.W. (1978) Principles of Petrology. Chapman and Hall Ltd., London.
2. Bowen, N.L.M. (1956) The Evolution of the Igneous Rocks. Dover publication, Inc, New York.
3. Barth, T.W. (1962) Theoretical Petrology. Wiley.
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5. Turner, F.J. and Verhoogen, J. (1960) Igneous and Metamorphic Petrology. McGraw Hill.
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9. Winter, J.D. (2001) An introduction to Igneous and Metamorphic Petrology. Prentice Hall, New Jersey.
10. Ehlers, G.E. and Blatt, H. (1999) Petrology – Igneous, Sedimentary and Metamorphic. CBS Publishers and Distributors, New Delhi.
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13. John D. Winter (2012) An Introduction to Igneous and Metamorphic Petrology. Prentice Hall.

Fifth Semester B.Sc. Geology
Syllabus of Core Course – VII

Semester	Hours/Week	Hours /Semester	Exam	Mark			Credits
				Internal	External	Total	
V	4 Hours	72 Hours	3 hours	20	80	100	4

GL 1542: SEDIMENTARY PETROLOGY AND METAMORPHIC PETROLOGY

COURSE OUTCOMES

CO 1: Understand and explain the basic concept of origin of sedimentary rocks, their classification, textures and structures.

CO 2: Understand, classify and explain the categorization of sedimentary rocks, describe the characteristics and classification of important sedimentary rocks like sandstone, limestone and acquire ideas of chemical and biochemical sedimentary rocks.

CO 3: Understand the concept of metamorphism and metamorphic rocks; explain the origin of metamorphic rocks, the factors, limits and types of metamorphism; and categorize and describe the metamorphic grade concept, metamorphic mineral zone concept and metamorphic facies concept.

CO 4: Understand and explain metamorphic textures and structures; describe the metamorphism of pelitic, carbonate and mafic rocks; illustrate and describe the petrography of some important metamorphic rocks.

SYLLABUS

GL 1542: SEDIMENTARY PETROLOGY AND METAMORPHIC PETROLOGY

Unit–I Origin of sediments. Diagenesis - Compaction, cementation, authigenesis, recrystallization and replacement. Classification of sedimentary rocks – Clastic and non-clastic rocks. Clastic texture - concept of size, Udden-Wentworth and Phi scale scheme. Grain shape, morphology and fabric. Non- clastic texture – different types of crystalline texture. Brief study of the following: Primary, secondary and organic structures. **(12 Hours)**

Unit–II Categorization of mechanical rocks: Argillaceous, arenaceous and rudaceous rocks. Introduction to the following: sandstone, shale, conglomerate and breccias. **(10 Hours)**

Unit–III Introduction to limestone, Classification of limestone – Folk and Dunham scheme. Brief study of the following chemical and biochemical sedimentary rocks: Calcareous, ferruginous, siliceous, phosphatic and evaporates. **(12 Hours)**

Unit–IV Definition of metamorphism. Factors of metamorphism - pressure, temperature, chemically active fluids, time and parent rock chemistry, Limits of metamorphism. Anatexis, palingenesis and migmatites. Metasomatism. Types of metamorphism – Contact metamorphism, Regional metamorphism – orogenic and ocean floor, Burial metamorphism, Cataclastic metamorphism, hydrothermal metamorphism Impact/shock metamorphism and plutonic metamorphism**.** **(12 Hours)**

Unit–V Metamorphic grade concept. Progressive and retrogressive metamorphism. Stability of minerals in P-T field. Metamorphic mineral zone concept - index minerals and Isograd, Metamorphic facies concept**.** **(12 Hours)**

Unit–VI Metamorphic textures – Crystalloblastic and Relict textures. Metamorphic structures – foliations, lineations, cataclastic and miscellaneous. Metamorphism of pelitic, carbonate and mafic rocks. Petrography of the following metamorphic rocks: Slate, Phyllite, Quartzite, Marble, Schists, Amphibolite, Gneisses, Eclogite, Blueschist, mylonite, Hornfels and Granulites – Charnockite (massive, incipient), Khondalite and Leptynite. **(14 Hours)**

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1. Tyrrell, G.W. (1978) Principles of Petrology. Chapman and Hall Ltd., London.
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3. Harker, A. (1964) Petrology for Students. Cambridge.
4. Folk, R.L. (1981) Petrology of Sedimentary Rocks. Hemphils Pub. Co.
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6. Winter, J.D. (2001) An introduction to Igneous and Metamorphic Petrology. Prentice Hall, New Jersey.
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Fifth Semester B.Sc. Geology
Syllabus of Core Course – VIII

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	3 Hours	54 Hours	3 Hours	20	80	100	4

GL 1543: PALAEONTOLOGY

COURSE OUTCOMES

CO 1: Understand and explain significance of palaeontology, the conditions and methods of fossilization, classification and nomenclature of fossils and the basic principles of Taxonomy, Systematics and Binomial nomenclature.

CO 2: Understand and explain the morphology, classification, geological history and stratigraphic importance of Phylum Protozoa, Phylum Coelenterata – Class Anthozoa, Phylum Brachiopoda, Phylum Mollusca – Classes Pelecypoda, Gastropoda, Cephalopoda.

CO 3: Understand and describe the morphology, classification, geological history and stratigraphic importance of Phylum Arthropoda – Class Trilobita, Phylum Echinodermata – Class Echinoidea and Phylum Hemichordata – Class Graptolithina.

CO 4: Understand the basic ideas of Micropalaeontology and describe the characteristics of important plant fossils.

SYLLABUS

GL 1543: PALAEONTOLOGY

Unit–I Scope and subdivisions of paleontology. Conditions and methods of fossilization, body fossils, trace fossils and micro fossils, Classification and nomenclature of fossils. Basic principles of Taxonomy and systematics. Binomial nomenclature, type specimens and kinds - holotype, genotype: Uses of fossils. **(6 Hours)**

Unit–II Phylum Protozoa: Morphology, Classification, geological history and stratigraphic importance. Phylum Coelenterata - Class Anthozoa - Morphology, Classification and stratigraphic range and important fossils. **(8 Hours)**

Unit–III Phylum Brachiopoda: General morphology, Umbo, Hinge line, Pedicle opening, Deltherium, Deltedium, Pseudodeltedium - brachial skeleton, Morphologic details, ornamentation, classification, geological history and important fossils.

Phylum Mollusca - Class Pelecypoda: General characters - Umbo, hinge line, ligament. Lunule and escutcheon, adductor impressions, palial line, palial sinus, dental patterns, ornamentation, classification, geological history and important fossils. **(12 Hours)**

Unit–IV Phylum Mollusca - Class Gastropoda: General morphology, shell forms, whorl, spire, spiral angle, suture, aperture, columella, umbilicus, peristome, aperture, (holostomatus and siphonostomatus), types of coiling – dextral and sinistral, ornamentation, classification and geological history and important fossils.

Phylum Mollusca – Class Cephalopoda: Morphology, classification, suture patterns, and geological history and important fossils. **(10 Hours)**

Unit–V Phylum Arthropoda, Class – Trilobita: General morphology: Cephalon: glabella, facial suture, free cheek, fixed cheek, genal angle, genal spine, cranidium; thorax – pygidium, classification, geological history and important fossils.

Phylum Echinodermata: Class Echinoidea: General morphology, periproct, apical system (Anus, ocular plates, Genital plates, madriporic plates), corona (Ambulacra, inter ambulacra) – peristome – Regular and irregular echinoids – classification – geological history and important fossils.

Phylum Hemichordata – Class Graptolithina: general morphology, geological history and important fossils. **(12 Hours)**

Unit–VI Micropalaeontology and Palynology: an introduction. Brief account of the following plant fossils - Glossopteris, Gangamopteris, Ptilophyllum, Calamites, Lepidodendron and Sigillaria. **(6 Hours)**

References

1. Woods, H. (1961) Invertebrate Palaeontolgy. Cambridge University Press.
2. Romer, A.S. (1966) Vertebrate Palaeontology. 3rd Edn., Chicago Univ. Press.
3. Arnold C,A. (1947) An Introduction to Palaeobotany. McGraw Hill.
4. Haq, B.U. and Boersma, A. (1978) Introduction to marine Micropalaeontology. Elsevier, Netherlands.
5. Raup, D.M. and Stanely, M.S. (1978) Principles of Palaeontology. CBS Publishers.
6. Moore, R.C., Lalicker, C.G. and Fishcher, A.G. (1952) Invertebrate Fossils, Mc-Graw Hill.
7. Shrock, R.R. and Twenhofel, W.H. (1953) Principles of Invertebrate Palaeontology. 2nd Edn. Mc-Graw Hill.
8. Brasier, M.D. (1980) Microfossils. George Allen & Unwin.

9. Bignot, G. (1985) Elements of Micropaleontology. IHRDC-Boston.
10. Nield, E.W.; Tucker, V.C.T. (1985) Palaeontology – An Introduction. Pergamon Press, Oxford, England.
11. Anis Kumar Ray, (2008) Fossils in Earth Sciences, Prentice-Hall of India Pvt. Ltd, New Delhi.

Fifth Semester Geology
Syllabus of Core Course – IX

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	3 Hours	54 Hours	3 Hours	20	80	100	3

GL 1544: ENVIRONMENTAL GEOLOGY

COURSE OUTCOMES

CO 1: Understand and explain the basic concepts of Environmental Geoscience, the environment, ecosystem; describe the significance of anthropogenic environment and natural resources, their classification, conservation, utilization and relation to the environment; explain the concept of sustainable development and highlight the impacts of mining on the environment.

CO 2: Understand and describe the various aspects of environmental especially water pollution and air pollution; explain air pollution in relation to climate change with importance to greenhouse effect and ozone depletion.

CO 3: Understand and describe the basic ideas of Environmental Planning and Management, Environmental Impact Assessment, Environmental awareness and the laws; describe the environmental impacts of urbanization, geology in relation to urban planning and the role of geologists in environmental conservation.

CO 4: Understand and explain various natural hazards like Earthquakes, Storms, Floods, Tsunamis, Volcanic activity, Landslides, Soil erosion and their environmental consequences.

SYLLABUS

GL 1544: ENVIRONMENTAL GEOLOGY

Unit–I Environmental Geoscience: Environment - concept, definition, scope and importance; Ecosystem - the physical environment, atmosphere, hydrosphere and lithosphere; Anthropogenic environment. **(8 Hours)**

Unit–II Natural Resources: Renewable and Non-renewable resources and their conservation. Natural resource utilization and environment. Concept of sustainable development. Impact of mining on the environment. **(8 Hours)**

Unit–III Environmental Pollution: Water pollution - causes, effects, prevention and control. Water quality parameters. Domestic, industrial and urban pollution. Heavy metal pollution. Solid waste disposal, Nuclear wastes. **(10 Hours)**

Unit–IV Air pollution - causes, effects, prevention and control. Air pollution and climate. Greenhouse effect and Ozone Depletion. **(10 Hours)**

Unit–V Environmental Planning and Management. Environmental Impact Assessment. Environmental Impact of urbanization. Geology and urban planning. Role of Geologist in conservation of environment. Environmental awareness and environmental laws. **(8 Hours)**

Unit–VI Natural hazards: Earthquakes, Storms, Floods, Tsunamis, Volcanic activity and Landslides - Environmental consequences of natural hazards. Soil erosion and its impact on environment. **(10 Hours)**

References:

1. Valdiya, K.S. (1987) Environmental Geology – Indian Context, Tata McGraw Hills.
2. Strahler, A.N. and Strahler, A.H. (1973) Environmental Geosciences, Wiley Eastern.
3. Donald. R. Coates (1981) Environmental Geology, John Wiley & Sons.
4. Peter. T. Elawan (1970) Environmental Geology, Harper & Row.
5. Keller, E.A. (1978) Environmental Geology, Bell & Howell, USA.
6. Bryante (1985) Natural Hazards, Cambridge University Press.
7. Das, R.C. and Behera, D.K. (2008) Environment Science Principles and Practice, Prentice Hall of India.
8. Davis, et. al., (1976), Environmental Geoscience, Wiley Eastern.
9. Howard, A.D. and Irwin Remson (1978). Geology in Environmental Planning, McGraw Hill Publishers.
10. Coates, D.R. (1985) Geology and Society, Chapman and Hall Publishers, New Delhi.

Fifth Semester B.Sc. Geology
Syllabus of Core Course – XIII (Practical)

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
V	6 Hours	108 Hours	Exam in VI Sem.	Internal	External	Total	3
				20	80	100	

(Note: Practical sessions in Fifth Semester; Practical examination in Sixth semester)

GL 1644: PETROLOGY AND PALAEONTOLOGY

COURSE OUTCOMES

CO 1: Understand and describe the megascopic and microscopic properties of important igneous, sedimentary and metamorphic rocks and identify the rocks.

CO 2: Understand, identify, draw and describe the megascopic characteristics of important fossils belonging to various Phyla and important plant fossils and identify them.

GL 1644: PETROLOGY AND PALAEONTOLOGY

I. Petrology

Megascopic identification of the following rocks:

Granite (Different Types), Graphic granite, Granite Porphyry, Pegmatite, Aplite, Syenite, Syenite-porphyry, Diorite, Gabbro, Anorthosite, Dunite, Dolerite, Basalt, Rhyolite, Nepheline Syenite, Pyroxenite, Peridotite.

Slate, Phyllite, Schist (different types), Gneiss (different types), Quartzite, Marble, Amphibolite, Ecologite, Leptynite, Charnockite, Khondalite, Mafic Granulite, Schorl rock, Banded Magnetite Quartzite.

Conglomerate, breccia, sandstone (coarse, medium, fine), limestone (micritic, dolomitic, marl, oolitic, fossiliferous), Shale, Laterite.

Microscopic identification and description of the following rocks:

Mica Granite, Hornblende Granite, Graphic Granite, Granite–porphyry, Syenite, Nepheline Syenite, Diorite, Gabbro, Dunite, Pyroxenite, Dolerite, Anorthosite, Basalt, Peridotite.

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

Sandstone (different types), Limestone (different types), Shale, Conglomerate, Breccia.

II. Palaeontology

Megascopic: Identification, drawing and description of the following fossils:

Anthozoa: Calceola, Zapherentis, Lithostrotion, Favosites, Halysites, Montlivaltia, Isastrea, Thecosmilia.

Brachiopoda: Spirifer, Productus, Terebratula, Rhynchonella, Lingula,

Echinodermata: Cidaris, Hemicidaris, Micraster, Hemiaster,

Lamellibranch: Arca, Cardita, Pecten, Trigonia, Megaladon, Gryphea, Exogyra, Ostrea, Inoceramus, Alectryonia, Hippurites.

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

Cephalopods: Nautilus, Ceratites, Acanthoceras, Turrilites and Belemnites

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

Graptolites: Phyllograptus, Tetragraptus, Diplograptus, Monograptus

Plant Fossils: Glossopteris, Gangamopteris, Ptilophyllum, Lepidodendron, Sigillaria, Calamites.

Fifth Semester B.Sc. Geology
Syllabus of Open Course – I

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1551.1: DISASTER MANAGEMENT

COURSE OUTCOMES

CO 1: Understand and explain the basic concepts, terminologies and classification of Hazard and Disaster; Disaster Management and Disaster Management Plan.

CO 2: Understand and describe the various natural disasters with suitable examples; Understand and explain the Environmental disasters by citing suitable examples; Describe facts related to climate change, causes and effects.

CO 3: Understand and describe the Disaster Risk management strategies; the institutional frameworks; explain the application of IT in Disaster Risk management; understand, categorize and describe disaster relief and its components; and explain Disaster Management Act and Policy.

CO 4: Understand and describe Hazard and vulnerability situation in India and Kerala; types of disasters in Kerala; explain accident related disasters, their prevention and mitigation; the application of GIS in Disaster management; and describe the significance of Emergency procedures and warning systems.

SYLLABUS

GL 1551.1: DISASTER MANAGEMENT

Unit–I Introduction – Hazard and Disaster: Definition and Terminologies - Classification. Concept of Disaster management - Comprehensive Disaster Management Plan. Elements of Disaster Management Plan. **(8 Hours)**

Unit–II Natural Disasters - Earthquake, Landslide, Avalanches, Volcanic eruptions - Their case studies. Heat and Cold Waves, Coastal disasters, Coastal regulation Zone, Cyclone, Flood, Drought, Tsunami. **(10 Hours)**

Unit–III Environmental Disasters - Dam collapse and Mitigation measures. Nuclear disasters, Chemical Disasters, Biological Disasters, Forest fire and Oil fire. **(8 Hours)**

Unit–IV Climate change: global warming, sea level rise, ozone depletion, carbon sink and sources - causes and effects. **(8 Hours)**

Unit–V Disaster Risk Management; Institutional arrangement: Prevention, Preparedness, and Mitigation; Disaster Preparedness Plan. Application of Information Technology in Disaster Preparedness. Hazards and Vulnerablity scenario in India; Disaster relief and its components – water, food, sanitation, shelter, health and waste management; Disaster Management Act and Policy. **(10 Hours)**

Unit–VI Kerala and disasters: types – Flood, Drought, Coastal erosion, Landslides, Pesticide contaminations. Accident related disasters, their prevention and mitigation. Application of GIS in Disaster Management. Emergency procedures and warning systems. **(10 Hours)**

References

1. David Alexander (1993) Natural Disasters, UCL Press, London.
2. Edward Bryant (2005) Natural Hazards, Cambridge University Press.
3. Patrick L. Abbott (2008) Natural Disasters, McGraw Hill International edition.
4. Rajib Shaw and Krishnamurthy R.R. (2008) Disaster management: Global Challenges and Local Solutions, Universities Press, Hyderabad, India.
5. Govt. of India (2005) Disaster Management Act, New Delhi.
6. Govt. of India (2009) National Disaster Management Policy.
7. Gupta, A.K. and Nair, S.S. (2011) Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi.
8. Murthy, R.K. (2012) Disaster management, Wisdom Press, New Delhi.
9. Vasudevan, V., Krishnan, K.R.S., Baba, M. and Kumar, P. (Eds.) (2006) Natural Hazards and Management Strategies, XVIII Kerala Science Congress – 2006, KSCSTE.

Fifth Semester B.Sc. Geology
Syllabus of Open Course – II

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1551.2: GEOSCIENCES AND ENVIRONMENT

COURSE OUTCOMES

CO 1: Understand and explain the subject meaning of Geology and its branches; describe the characters of earth; explain hydrologic cycle and role of groundwater.

CO 2: Understand and describe the various exogenic and endogenic processes that form a part of earth system, including earthquakes and volcanoees; and explain the role played by the geological agents in shaping earth.

CO 3: Understand and describe the natural resources and their classification; resources management and associated problems.

CO 4: Understand and describe Global climate change, causes and effects; explain the significance of pollution and waste disposal.

SYLLABUS

GL 1551.2: GEOSCIENCES AND ENVIRONMENT

Unit–I Introduction to Geology - branches of Geology, the earth - size, shape, density, volume and internal structure. Hydrologic cycle, groundwater - Infiltration, zones of groundwater, ground and perched water tables, open wells and bore wells. **(8 Hours)**

Unit–II Exogenic processes: Weathering – agents, types and products of weathering. Mass wasting - types, Landslides. Brief ideas of role played by streams, oceans, wind and glaciers on earth's surface. **(10 Hours)**

Unit–III Endogenic processes: Volcanoes – types and distribution of major volcanoes, products of volcanism - gas, dust, lava and pyroclastics. **(8 Hours)**

Unit–IV Earthquakes – Seismic waves and propagation, epicenter and focus, intensity and magnitude scales, Seismographs and seismogram, Tsunami. **(8 Hours)**

Unit–V Natural resources – Renewable and non renewable resources - Natural resources management and associated problems. Soil, Water and Mineral/Rock resources, Fossil fuels – Coal and Petroleum. **(10 Hours)**

Unit–VI Global Climate change: Greenhouse effect, Global warming, Ozone depletion - causes and effects. Pollution and waste disposal – air, water and land pollution; brief ideas of causes and effects. **(10 Hours)**

References

1. Carlson, D. and Plummer, C. (2010) Physical Geomorphology: Earth Revealed. 9th Edn., Mc-Graw Hill Co.
2. Bloom, A. L. (1992) Geomorphology, Second Edition, Prentice Hall India Pvt. Ltd., New Delhi.
3. Holmes, A. (1981) Principles of Physical Geology, ELBS, Third Edition. Thomas Nelson.

4. Judson, S. and Kauffman, M. E. (1990) Physical Geology. Eighth Edition, Prentice Hall, New Jersey.
5. Parbin Singh (2012) General and Engineering Geology. S. K. Kataria and Sons.
6. Mukherjee, P.K. (1984) A Text Book of Geology, World Press.
7. Valdiya, K.S. (1987) Environmental Geology: Indian Context, Tata Mc-Graw Hills.
8. Strahler, A.N. and Strahler, A.H. (1973) Environmental Geosciences: Interaction between natural systems and man. John Wiley & Sons Inc.
9. Donald R Caotes (1981) Environmental Geology. John Wiley and Sons.
10. Keller, E.A. (1978) Environmental Geology. Bell and Howell, Prentice Hall, USA.
11. Bryant, E. (1985) Natural Hazards. Cambridge University Press.
12. Coates, D.R. (1985) Geology and Society. Chapman and Hall Publishers, New Delhi.

Fifth Semester B.Sc. Geology
Syllabus of Open Course – III

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1551.3: GEMMOLOGY

COURSE OUTCOMES

CO 1: Understand the basic ideas of Gemmology, describe the characteristics of gemstones; explain Navaratnas and their significance; understand and describe valuing and grading of gemstones and explain techniques of cutting and polishing of gemstones.

CO 2: Understand and describe the various techniques of gemstone treatments; explain the differences of natural, artificial and synthetic gemstones; describe the physical properties and classification of gemstones.

CO 3: Understand and describe the properties of important gemstones like Diamond, ruby, sapphire, emerald, jade, garnet, amethyst, topaz, quartz, tourmaline etc.

CO 4: Understand and describe the industrial application of gemstones; understand and categorize the Indian and World industrial gemstone centres; explain the distribution of gemstones in India and in Kerala.

SYLLABUS

GL 1551.3: GEMMOLOGY

Unit–I Gemmology - Definition and scope, Characteristics of gemstones – color – cut – carat, chatoyancy. Navaratnas and their significance. **(8 Hours)**

Unit–II Value and grading of gemstones, Cutting and polishing of gemstones. **(8 Hours)**

Unit–III Treatments Applied to gemstones - Heating, radiation. waxing, oiling. Fracture filling. Natural, Synthetic and Artificial gemstones. **(10 Hours)**

Unit–IV Physical properties of gemstones, Classification of gemstones - Precious and semiprecious. **(10 Hours)**

Unit–V Diamond – ruby – sapphire – emerald – jade – garnet – amethyst – topaz – quartz – tourmaline – their properties as gemstones. **(10 Hours)**

Unit–VI Industrial applications of gemstones. Gem industrial centres in India and world. Gemstone distribution in India. Gemstones of Kerala. **(8 Hours)**

References

1. Read, Peter G. (2005) Gemmology. 3rd ed. Elsevier, Amsterdam; New York.
2. Liddicoat, R.T. (1969) Handbook of gem identification, Gemological Institute of America.
3. Read, P.G. (1982) Dictionary of Gemology, Butterworths Scientific, London.
4. Arthur Thomas (2008) Gemstones: Properties, Identification and Use, New Holland Publishers.
5. Michael O'Donoghue and Butterworth-Heinemann (2006) Gems: Their Sources, Descriptions and Identification, 6th Edn. NAG Press.
6. Karanth, R. V. (2000) Gems and Gem Industry in India. Geological Society of India, Bangalore, India.
7. Karanth, R. V. (2008) Gemstones: Enchanting Gifts of Nature. Geological Society of India, Bangalore, India.
8. Kurt Nassau (1994) Gemstone Enhancement - History, Science and State of Art – 2nd Edition. Oxford: Butterworth-Heinemann.

Fifth Semester B.Sc. Geology
Syllabus of Project and Study Tour / Fieldwork

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
V	2 Hours	36 Hours	In VI Sem.	-	-	-	--

GL 1646: PROJECT AND STUDY TOUR/FIELD WORK

COURSE OUTCOMES

CO 1: Understand the techniques of geological mapping, the instruments used during geological fieldwork and carry out geological field work and collect geological samples.

CO 2: Visit recognized geological institutions and research departments within India and understand the geological activities and research carried out by these institutions and departments; and develop the knowhow of geological fieldwork report writing.

GL 1646: PROJECT AND STUDY TOUR/FIELD WORK

PART A: STUDY TOUR/ FIELD WORK

Since Geology is a field oriented science, study tour and field work forms an inevitable part of the course. Geological formations have to be studied on a vast dimension and exposures of rocks are sparsely distributed. So the study cannot be restricted to a class room or in a small area. For proper understanding of the subject, students should be taken to various parts of the country especially through Ghats, mines, beaches, oceans, rivers, plateaus, deserts, glaciers, mountains, lakes, backwaters etc. Geological mapping is also very important and students should be able to do mapping at the end of the course. Field work is highly essential for the completion of the course.

Moreover they have to visit institutions where geological investigations and research works are going on. Sample collection and report writing also forms part of the study. Study tour

and field work can be carried out in all the three years of study but essential in the Final Year of study. Study tour/Field work in geologically significant areas is compulsory for completing the course and must be completed in the fifth semester itself. The study tour/field work report evaluation and sample display evaluation will be conducted during the VI Semester practical examinations.

Sixth Semester B.Sc. Geology
Syllabus of Core Course – X

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	4 Hours	72 Hours	3 Hours	20	80	100	4

GL1641: ECONOMIC GEOLOGY

COURSE OUTCOMES

CO 1: Understand history of development of Economic Geology, the terminologies associated with the subject and the classification schemes of economic mineral deposits.

CO 2: Understand and explain the various processes of formation of ore mineral deposits, both internal processes and external processes.

CO 3: Understand and describe metallogenic epochs and provinces with reference to India and mode of occurrence, distribution in India and important economic uses of important ore minerals; understand and describe materials for Abrasives, Refractories, Ceramics and Cement; Gemstones; Strategic and Critical minerals.

CO 4: Understand and describe the Mineral Policy of India; the detailed account of the fuel minerals coal and petroleum, with reference to their origin, mode of occurrence and distribution in India.

SYLLABUS

GL1641: ECONOMIC GEOLOGY

Unit–I Definition - scope and historical development of Economic Geology, ore minerals and gangue minerals, tenor and grade of ores. Primary and secondary classification of mineral deposits - Bateman's classification**.** **(10 Hours)**

Unit–II Processes of formation of mineral deposits: Origin due to internal processes - Magmatic deposits, Hydrothermal deposits, Contact metasomatic deposits, Metamorphic deposits. **(13 Hours)**

Unit–III Processes of formation of mineral deposits: Origin due to External / Surface processes - Evaporite deposits, Sedimentary deposits - mechanical concentration, residual concentration, Oxidation and Supergene enrichment, Volcanic exhalative deposits. **(13 Hours)**

Unit–IV Metallogenic Epochs and Provinces with particular reference to India. A brief study on mode of occurrence, distribution in India and important economic uses of ore minerals of the following - Aluminium, Chromium, Gold, Iron, Copper, Lead, Manganese, Silver, Thorium, Titanium, Uranium and Zinc. Mineral resources of Kerala. **(14 Hours)**

Unit–V Materials for Abrasives, Refractories, Ceramics and Cement. Gemstones. Strategic and Critical minerals. Mineral Policy of India. **(10 Hours)**

Unit–VI Fuel minerals: Coal – origin, theories of origin; coal resources in India – classification and distribution. Petroleum – origin and brief study on the petroliferous basins of India**;** theories of origin – Source rocks – Cap rocks – Traps – Structural – Stratigraphic - Distribution. **(12 Hours)**

References

1. Anthony M. Evans (1980). An introduction to Ore Geology, second edition, ELBS.
2. Gokhale, K. V. G. K. and Rao, T.C. (1978) Ore Deposits of India. Thomson Press (India).
3. Krishnaswamy, S. (1988) Indian Mineral Resources. South Asia Books.
4. Mead L. Jensen and Alan M. Bateman (1981). Economic Mineral Deposits, John Wiley & Sons Third edition, revised printing.
5. Park and Macdiarmid (1964). Ore Deposits, Freeman.
6. Roy Chacko (ed.) (2005) Mineral Resources of Kerala. Dept of Mining and Geology.
7. Soman, K. (2002) Geology of Kerala, Geological Society of India, Second revised edition.
8. Umeshwer Prasad (1996). Economic Mineral Deposits, CBS Publishers.
9. Wadia, D.N. (1994) Minerals of India, National Book Trust, India, 5th edition.
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Sixth Semester B.Sc. Geology
Syllabus of Core Course – XI

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	5 Hours	90 Hours	3 Hours	20	80	100	4

GL 1642: STRATIGRAPHY AND STRUCTURAL GEOLOGY

COURSE OUTCOMES

CO 1: Understand and describe the basic principles of Stratigraphy and breaks in stratigraphic successions and their significance; understand and explain the elements of stratigraphic classification, Geological Time Scale, Stratigraphic correlation and define typical terms related to stratigraphic studies.

CO 2: Understand and describe the basic terminologies in Structural Geology, the Rule of V's and characteristics of primary and secondary structures.

CO 3: Understand and describe rock deformation, the different stages; concepts and applications of stereographic projection in Structural Geology, foliations and lineations; and geological mapping techniques and procedures.

CO 4: Understand and describe the folds, faults and joints with reference to their origin, terminologies, classification and geological significance.

SYLLABUS

GL 1642: STRATIGRAPHY AND STRUCTURAL GEOLOGY

Unit–I Scope and basic principles - Uniformitarianism, Superposition, Lateral continuity, Original horizontality, faunal succession, faunal assemblage - Breaks in stratigraphic successions – Hiatus – unconformities – nonsequences – diastems and their significance. **(14 Hours)**

Unit–II Elements of lithostratigraphic, chronostratigraphic and biostratigraphic classification. Type area, Transported and leaked fossils. Geologic time scale and time units, Stratigraphic correlation, criteria and methods. Index fossils, Overlap and offlap.

(16 Hours)

Unit–III Introduction: Attitude of planar linear structures Strike, Dip, Plunge and Pitch. Width of outcrops. Outlier and Inlier. Overlap and offlap. Rule of V's. Primary and secondary structures. Use of primary structures in determining top of beds.

(14 Hours)

Unit–IV Rock deformation – Stress and strain. Stages of rock deformation. Basic concept of spherical and stereographic projections in Structural Geology. Wulf net and Schmidt net.

Foliation and Lineation - Introduction and types. Geological Mapping - Procedures and equipments in mapping. **(14 Hours)**

Unit–V Fold - Terminology. Classification of folds - Geometric and genetic. Recognition of folds in field and map. Unconformities -Types and their recognition in the field and in the maps. **(16 Hours)**

Unit–VI Faults – Terminology and classification. Mechanics of faulting. Criteria for recognition of faults in field and map.

Joints – Nature, Origin, Classification and their geological significance.

(16 Hours)

References

1. Billings (1974) Structural Geology. 11th edition, Prentice Hall.
2. Park R. G. (1997) Foundations of Structural Geology 3rd, Chapman & Hall.
3. Hills, E. S. (1961) Elements of Structural Geology, Asia Publishing House.
4. Hobbs, Means and Williams (1976). An Outline of Structural Geology. John Wiley.
5. John Robberts (1982) Introduction to Geological Maps and Structures, Pergamon Press.
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Sixth Semester B.Sc. Geology
Syllabus of Core Course – XII

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	5 Hours	90 Hours	3 Hours	20	80	100	4

GL 1643: STRATIGRAPHY OF INDIA

COURSE OUTCOMES

CO 1: Understand and describe the physiographic and geological divisions of India and acquire knowledge about cratons and mobile belts.

CO 2: Understand and describe the Early Precambrian and Late Precambrian formations of India with emphasis on lithology, classification, age, structure, syn- and post- tectonic intrusives, organic remains, radiometric age and economic resources.

CO 3: Understand and describe the important Palaeozoic, Mesozoic and Cenozoic formations of India with reference to their distribution, lithology, classification, fossils and age.

CO 4: Understand and describe the stratigraphy of Kerala and explain the characteristics of the Precambrian terrain of Kerala.

SYLLABUS

GL 1643: STRATIGRAPHY OF INDIA

Unit–I Brief study of the physiography divisions of India - Major geological divisions of India. Concept of Cratons and mobile belts. **(10 Hours)**

Unit–II General study of the distribution and nomenclature of Early Precambrians of India. Major cratons and fold belts of the Indian shield. Detailed study of the lithology, classification, age, structure, syn- and post- tectonic intrusives, organic remains, radiometric age and economic resources of Dharwar Craton - Sargur Schist Complex, Peninsular Gneiss, Dharwar Supergroup, Aravalli Supergroup of Rajasthan. **(18 Hours)**

Unit–III 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 Group. **(18 Hours)**

Unit–IV A brief study of the distribution of marine Paleozoic and Mesozoic successions of India and detailed study of the following - Paleozoic and Triassic successions of Spiti, Jurassic of Spiti and Kutch. Cretaceous of Trichinopoly and Narmada valley, Gondwana Supergroup -Distribution, lithology, classification, age, structural features, fossils and coal resources. **(18 Hours)**

Unit–V: 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 Hours)**

Unit–VI Stratigraphy of Kerala, Precambrian terrain of Kerala, Tertiaries of Kerala, Karewas of Kashmir, Indo-Gangetic Alluvium. **(12 Hours)**

References

1. Krishnan, M.S. (1982) Geology of India and Burma, 6th Edition, CBS.
2. Wadia, D.N. (1944) Geology of India, Tata McGraw–Hill.
3. Ravindra Kumar (2020) Fundamentals of Historical Geology and Stratigraphy of India. 2nd edition, New Age International Private Limited.
4. Pascoe, E.H. (1954) A Manual of the Geology India and Burma, Govt. of India Publications.
5. Vaidyanathan and Ramakrishnan (2008). Geology of India (Vol. I & II). Geological Society of India, Bangalore.
6. Soman, K. (2013) Geology of Kerala, Geological Society of India, Bangalore.
7. Radhakrishna, B.P and R. Vaidyanadhan (1997) Geology of Karnataka, Geological Society of India, Bangalore.
8. Sanjib Chandra, Sarkar, Anupendra Gupta (2012). Crustal evolution and Metallogeny in India. Cambridge University Press, Delhi, India.
9. Amal Das Gupta (2006). An introduction to Earth Science, World Press Private Limited, Kolkata.

Sixth Semester B.Sc. Geology
Syllabus of Core Course – XIV (Practical)

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	6 Hours	108 Hours	3 Hours	20	80	100	3

GL 1645: ECONOMIC GEOLOGY AND STRUCTURAL GEOLOGY

COURSE OUTCOMES

CO 1: Understand, describe the megascopic properties and identify important ore and industrial minerals.

CO 2: Understand and illustrate the important structural features and attitude of beds; Rule of V's, draw and carry out the procedures of analysis of geological maps with different structural features; work out problems related to true and apparent dip, true vertical thickness and width of out crops and solve three point problems; and draw stereographic projections of structural features.

GL 1645: ECONOMIC GEOLOGY AND STRUCTURAL GEOLOGY

I. Economic Geology

Megascopic identification and description, Indian occurrence and uses of the following ore and industrial minerals:-

1. Sulphides: Realgar, Orpiment, Stibnite, Galena, Sphalerite, Chalcopyrite, Pyrite.
2. Sulphates: Barite, Celestite, Gypsum.
3. Oxides: Corundum, Hematite, Ilmenite, Magnetite, Chromite, Pyrolusite, Psilomelane, Bauxite.
4. Carbonates: Calcite, dolomite, Magnesite, Argonite, Azurite, Malachite.
5. Industrial minerals: Halite, Fluorite, Monazite, Graphite, Asbestos

II. Structural Geology

1. Diagrammatic illustration of structural features - Attitude of beds - true and apparent dip, strike and dip symbols, rule of V, Types of folds, faults, joints and unconformities.
2. Maps with suitable sections and geologic descriptions
    - Simple horizontal beds
    - Illustrating Rule of Vs
    - Simple dipping beds
    - Simple dipping beds with intrusions
    - Problems involving bore hole data, thickness, dip and apparent dip
    - Dipping beds with unconformity
    - Folded beds
    - Maps with different types of faults
    - Combination maps (Unconformity, folds, faults, intrusions)
3. Problems involving true and apparent dip, true vertical thickness and width of out crops. Three point problems. Stereographic projection of linear and planar features.

Sixth Semester B.Sc. Geology
Syllabus of Elective Course – I

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1661.1: GROUNDWATER INVESTIGATION AND MANAGEMENT

COURSE OUTCOMES

CO 1: Understand groundwater in relation to hydrological cycle and explain hydrometeorology and its significance; describe hydrological measurements of important parameters.

CO 2: Understand and describe the occurrence of groundwater, the properties of aquifers and their types; define and explain the Darcy's law governing groundwater movement and flow directions.

CO 3: Understand and describe the groundwater investigation techniques and pumping tests for determination of aquifer parameters.

CO 4: Understand and describe the groundwater provinces of India and the groundwater conditions in Kerala.

SYLLABUS

GL 1661.1: GROUNDWATER INVESTIGATION AND MANAGEMENT

Unit–I Hydrological cycle and hydrometeorology. Global distribution of fresh water, Hydrological measurements - precipitation, evaporation, soil moisture, soil infiltration and river flow. **(8 Hours)**

Unit–II Zones of aeration and saturation, water table and potentiometric surfaces, porosity, permeability, aquifer, aquiclude, aquifuge. **(8 Hours)**

Unit–III Types of aquifers – confined and unconfined; Artesian aquifers; Perched aquifers, Leaky or Semi-confined aquifers; Darcy's law, hydraulic head and groundwater flow directions. **(10 Hours)**

Unit–IV Groundwater investigation techniques - geophysical exploration methods with special emphasis on electrical resistivity method, well logging, tracer techniques. **(10 Hours)**

Unit–V Pumping test and determination of safe yield, water conservation methods - check dams, ponds, sub surface dykes, concept of artificial recharging of groundwater. **(10 Hours)**

Unit–VI Hydrogeological provinces of India. Groundwater status in India. Major aquifers and groundwater exploitation in Kerala. **(8 Hours)**

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1. Todd, D.K. (1980). Groundwater Hydrology. John Wiley & Sons.
2. Todd, D.K. and L.W. Mays (2004). Groundwater Hydrology. 3rd Edn. John Wiley & Sons.
3. Davis, S.N. & Deweist, R.J.M. (1966). Hydrogeology, John Wiley & Sons, New York.
4. Ragunath, H.M (2007). Groundwater, New Age International Publishers, Delhi
5. Karanath, K.R. (1987). Groundwater Assessment, Development & Management, Tata Mc-Graw Hill.
6. Ramakrishnan, S. (1998). Groundwater. K.G. Graph Arts, Chennai.

Sixth Semester B.Sc. Geology
Syllabus of Elective Course – II

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1661.2: MARINE GEOLOGY

COURSE OUTCOMES

CO 1: Understand the morphological features of ocean floor with reference to Indian Ocean and describe the distribution various parameters in sea water and explain eustatic sea level changes.

CO 2: Understand and describe the oceanographic expeditions, ocean floor drilling programmes and ocean floor mapping and understand and explain marine pollution.

CO 3: Understand and describe the types of coasts and coastal geomorphological features and processes; explain tides and law of the sea.

CO 4: Understand and describe the different type of marine sediments and their distribution; explain the mineral resources of ocean floor including coal and petroleum.

SYLLABUS

GL 1661.2: MARINE GEOLOGY

Unit–I Morphology of ocean floor, Mid-oceanic ridge system, Subduction zones, island arcs, trenches, conjugate oceanic basins, seamounts. Guyots and ridges. Morphology of Indian Ocean. **(8 Hours)**

Unit–II Distribution of temperature, salinity and density in sea water, nutrients in sea water, Eustatic changes of sea level and their effects. **(8 Hours)**

Unit–III Oceanographic expeditions, Ocean floor drilling programmes - ODP, DSDP and JOIDES. Ocean floor mapping - Echo sounding - multi beam survey and ROVs. Marine pollution - Oil spill, algal blooms, industrial effluents. **(10 Hours)**

Unit–IV Types of coasts and coastal geomorphology, coastal upwelling and downwelling, turbidity currents and turbidites, Mud banks, Tides and their origin, Law of the sea - EEZ and CRZ. **(8 Hours)**

Unit–V Marine Sediments - Classification and distribution. Factors controlling the deposition and distribution of oceanic/marine sediments - Biogenous, Cosmogenous, Hydrogenous, Terrigenous and Authigenic. **(10 Hours)**

Unit–VI Mineral resources of the oceans – Distribution and classification of minerals of economic importance in different oceanographic settings: Seawater as a source of elements/minerals. Placer and heavy mineral deposits, petroleum and coal, phosphorites, phosphatic deposits, gas hydrates, poly-metallic nodules, metals enriched crusts, hydrothermal and metalliferous sediments, volcanogenic massive sulfide deposits (VMS). **(10 Hours)**

References

1. Pinet Paul, R. (1992). Oceanography – An Introduction to the Planet Oceanus, West Publishing Co.
2. Pond, S. and Pickard, G. L. (1983). Introductory Dynamical Oceanography, 2nd Ed., Pergamon Press.
3. King, C. A. M. (1972). Beaches and Coasts, Arnold, London.
4. Trask P. D. (1939). Recent Marine Sediments, Denver Publications.
5. Krumbein, W. C. and Pettijohn, F. J. (1938). Manual of Sedimentary Petrology, Appleton Century Co.
6. Pickering, K. T. Hiscott, R. N. and F. J. Hedn (1989). Deep Marine Environments – clastic sedimentation and Tectonics, Unwin and Hyman.
7. Roy Chester (1990). Marine Geochemistry, Unwin Hyman.
8. Selley, R.C. (1972). Ancient Sedimentary Environments, Corwell University Press.
9. Pettijohn, F. J., Potter, P. E. and Siever, R., Sand and Sandstone (1972). Springer Verlag.
10. Shepard F. P. (1963) Submarine Geology, Harper & Row, New York.

Sixth Semester B.Sc. Geology
Syllabus of Elective Course – III

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	3 Hours	54 Hours	3 Hours	20	80	100	2

GL 1661.3: ENGINEERING GEOLOGY

COURSE OUTCOMES

CO 1: Understand and explain the role of Geologists in designing and constructing Civil Engineering structures, describe the process of weathering and soil formation from rocks and the engineering properties of rocks.

CO 2: Understand and describe soil mechanics in relation to engineering properties of soil, its classification determination of important soil properties and particle size analysis of soils relevant to civil engineering considerations.

CO 3: Understand and describe the geological considerations in dams and reservoirs, tunnels, roads, railways, bridges and buildings; explain mass movements, their types and relevance of slope stability; and give details of the geological materials used in construction and their physical characters.

CO 4: Understand and explain the significance of earthquakes and seismicity, the seismic zones in India, aseismic design of buildings; describe beach engineering and its significance.

SYLLABUS

GL 1661.3: ENGINEERING GEOLOGY

Unit–I Introduction to Engineering Geology. Role of Engineering geologists in planning, design and construction of major man-made structural features. Weathering and its significance in engineering, origin of soils, soil profile, Engineering properties of rocks: strength, hardness, elasticity, porosity and specific gravity; rock mass and its characteristics; Rock discontinuities. **(8 Hours)**

Unit–II Soil mechanics; Physical and engineering properties of soil - unit weight, specific gravity, bulk density, porosity, void ratio, water content, degree of saturation; shear strength of soil; concept of Atterberg limit and soils, Engineering classification of soils. Determination of water content in soils, specific gravity of soils, void ratio, porosity. **(10 Hours)**

Unit–III Particle size analysis of soils; Particle size distribution curve and its uses, plasticity of soils, consistency limits, permeability of soils, coefficient of permeability. **(8 Hours)**

Unit–IV Geological considerations involved in the construction of dams and reservoirs, tunnels, roads, railways, bridges and buildings. Mass Movements with special emphasis on landslide and causes of hill slope instability; stability of slopes. **(10 Hours)**

Unit–V Geological materials used in construction, Building stones, roofing and facing materials. Physical characters of building, ornamental stones and Concrete aggregates. **(8 Hours)**

Unit–VI Earthquake and seismicity; seismic zones of India; aseismic design of building; engineering problems related to precautionary measures and mitigations of hazards; beach engineering. **(10 Hours)**

References

1. Krynine D.P. and Judd W.R. (1957) Principles of Engineering Geology & Geotechnics. McGraw-Hill Book.
2. Kesavulu, N.C. (2009) A Text book of Engineering Geology. Macmillan Publishing India Ltd.
3. Crozier. M.J. (1989) Landslides: causes, consequences and environment. Academic Press.
4. Bell, F.G. (1983) Fundamentals of Engineering Geology. Butterworth and Co.
5. Parbin Singh (2013) Engineering & General Geology. S.K. Kataria & Sons.

Sixth Semester B.Sc. Geology
Syllabus of Core Course - Project and Study tour/Field work

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
VI	2 Hours	36 Hours	VI Sem.	-	-	-	4

GL 1646: PROJECT AND STUDY TOUR / FIELD WORK

COURSE OUTCOMES

CO 1: Understand the techniques of geological mapping, the instruments used during geological fieldwork and carry out geological field work and collect geological samples.

CO 2: Visit recognized geological institutions and departments within India and understand the geological activities and research carried out by these institutions; and develop the knowhow of geological fieldwork report writing.

CO 3: Carry out geological field work under an assigned project scheme, collect samples, do laboratory analysis, create relevant maps and diagrams and prepare a report of the work done based on field work and laboratory analysis.

GL 1646: PROJECT AND STUDY TOUR / FIELD WORK

PART: B – PROJECT

Project work forms an integral part of the three year degree course of the university. Project work should begin soon after the commencement of the VI semester and a work/problem should be identified with the help of a supervising teacher. In the project report importance should be given to the relevance of the topic, statement of objectives, methodology, style of presentation, findings/suggestions and finally for bibliography. Project work can be done individually or as a group of students. Project report in triplicate shall be submitted to the department at the end of sixth semester before the examination starts. This will be evaluated by the external examiners appointed by the university.

Internal assessment of the Project and Study tour/Field work will be done by the concerned teacher/s at the end of the each semester and the internal marks will be awarded as per the guidelines provided at the beginning.

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GEOLOGY AS COMPLEMENTARY COURSE FOR GEOGRAPHY

THEORY

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

PRACTICAL

Semester No.	Code No. and Name of Paper	Total Hours	Credits
IV	**GL 1432 – Geology Practical**	**36**	**4**

First Semester B.Sc. Geography
Syllabus of Complementary Course – I

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
I	2 Hours	36 Hours	3 Hours	20	80	100	2

COURSE OUTCOMES

CO 1: Understand and describe the basic facts of the earth, its age and the Geological Time Scale; explain the different processes operating on the earth and within the earth.

CO 2: Understand and explain weathering as an earth process, its agents, types and products; describe soil formation, typical soil profile and soil types of India.

CO 3: Understand and describe mountains, their types; and the concepts of orogeny and isostasy; explain mass movements, their types, causes and effects of landslides.

CO 4: Understand and describe groundwater as a geological agent with reference to its origin, occurrence, types of aquifers, springs, recharge of groundwater, types of wells and geological action.

SYLLABUS

GL 1131: GEOLOGY I: PHYSICAL GEOLOGY

Unit–I Geology – an introduction. The earth - its dimensions, age and internal structure, Relative age and absolute age of the earth. Concept of Geological Time Scale. **(6 Hours)**

Unit–II Processes in Geology - agents, energy, and classification; Endogenic processes and Exogenic processes. The Rock cycle, and the three rock types, Plate tectonics, palaeomagnetism, sea floor spreading. **(6 Hours)**

Unit–III Weathering – agents, types and products. Physical weathering and chemical weathering. Influence of climate and lithology on soil formation. Soils - their formation, types in India and a typical tropical soil profile. **(7 Hours)**

Unit–IV Mountains – types; Fold mountains, Fault/Block mountains and Volcanic mountains. Orogeny, Isostasy. **(5 Hours)**

Unit–V Mass movements – different types and their classification. Causes and effects of Landslides. **(5 Hours)**

Unit–VI Groundwater and its sources. Sources of groundwater. Hydrologic cycle. Subsurface occurrence of groundwater. Aquifer, aquiclude, aquitard, aquifuge - types of aquifers - confined and unconfined and artesian aquifers - springs, Recharge and discharge of groundwater - different types of wells. Geological work of groundwater.

(7 Hours)

Second Semester B.Sc. Geography
Syllabus of Complementary Course – II

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
II	2 Hours	36 Hours	3 Hours	Internal	External	Total	2
				20	80	100	

GL 1231: GEOLOGY II: GEOMORPHOLOGY AND MINERALOGY

COURSE OUTCOMES

CO 1: Understand and describe different aspects of streams, their geological actions, landforms produced and the concepts of graded stream and base level of erosion.

CO 2: Understand and describe glaciers and oceans and seas as agents of geological action and the landforms produced.

CO 3: Understand and explain volcanoes and earthquakes, seismic belts of the world and illustrate the interior of the earth.

CO 4: Understand and describe minerals and crystals; explain the physical properties of minerals; and describe the chemical composition and physical properties important minerals.

SYLLABUS

GL 1231: GEOLOGY II: GEOMORPHOLOGY AND MINERALOGY

Unit–I Streams – overland flow, channel flow, types of streams, drainage basin, 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. **(6 Hours)**

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. **(7 Hours)**

Unit–III Volcanoes - mechanism, types, products. Distribution of volcanoes, volcanic

landforms. Earthquakes - causes, types, seismic waves, epicenter, focus, isoseismal lines, intensity and magnitude, seismic belts. Interior of the earth. **(7 Hours)**

Unit–IV Minerals and crystals - study of crystals and its significance in mineral identification; morphology of crystals; scope and aim of mineralogy, rock forming minerals and ore forming minerals, examples. **(5 Hours)**

Unit–V Physical properties of minerals - colour, streak, lusture, transparency, fracture, cleavage, hardness, specific gravity, magnetism. **(5 Hours)**

Unit–VI 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, Actionolite, Beryl, Magnesite, Fluorite, Talc, Pyrolusite, Galena, Dolomite, Corundum, Graphite, Sphalerite, Diamond, Coal, Asbestos, Monazite, Bauxite. **(6 Hours)**

Third Semester B.Sc. Geography
Syllabus of Complementary Course – III

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
III	2 Hours	36 Hours	3 Hours	20	80	100	2

GL 1331: GEOLOGY III: PETROLOGY AND STRUCTURAL GEOLOGY

COURSE OUTCOMES

CO 1: Understand and describe magma as source of igneous rocks; describe the texture, mode of occurrence and classification of igneous rocks and the megascopic properties of important igneous rocks.

CO 2: Understand and describe sedimentary rocks, their textural and structural features, types of sedimentary rocks and megascopic properties of important sedimentary rocks; understand metamorphism and metamorphic rocks, their formation, factors of formation, textures and megascopic properties of important metamorphic rocks.

CO 3: Understand and explain the different aspects of topographical maps and geological maps; structural features and attitudes of rocks and geological significance.

CO 4: Understand and describe folds, faults and joints with reference to geometrical elements, types and geological significance and explain foliations and lineations.

SYLLABUS

GL 1331: GEOLOGY III: PETROLOGY AND STRUCTURAL GEOLOGY

Unit–I 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 studies of igneous rock types - granite, pegmatite, rhyolite, dunite, dolerite, pumice, syenite, gabbro, diorite, basalt. **(6 Hours)**

Unit–II 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. **(6 Hours)**

Unit–III Metamorphism - types and factors. Texture of metamorphic rocks. Megascopic study of the following metamorphic rocks - phyllite, slate, schist, gneiss, quartzite, marble, granulite, charnockite, khondalite. **(6 Hours)**

Unit–IV Topographical maps and geological maps - their preparation, conventional symbols. Structural features controlling landform development. Outcrops, strike and dip of the surfaces, primary and secondary structures, unconformities and their geological significances. **(6 Hours)**

Unit–V Fold, geometrical elements – geometrical classification, brief study of the following – antiform, synform, anticline, syncline, isoclinal fold, recumbent fold, overturned fold, geanticline, geosyncline, anti and synclinorium **(6 Hours)**

Unit–VI Faults – terminologies, type, study of the following – normal, reverse, strike slip and dip slip faults, horst, graben, rift valley. Joint- types and geological significance, Foliation and lineation. **(6 Hours)**

Fourth Semester B.Sc. Geography
Syllabus of Complementary Course – IV

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
IV	2 Hours	36 Hours	3 Hours	20	80	100	2

GL 1431: GEOLOGY IV: STRATIGRAPHY, PALEONTOLOGY AND ECONOMIC GEOLOGY

COURSE OUTCOMES

CO 1: Understand and describe the basic ideas and principles of stratigraphy, the Geological Time Scale and the units; understand and explain the major geological divisions of India and stratigraphy of Kerala.

CO 2: Understand and describe Palaeontology, fossils, fossilization, uses of fossils and morphological features of important fossils.

CO 3: Understand the subject matter of Economic Geology and describe the various processes of ore formation and the ore deposits produced.

CO 4: Understand and describe the mode of occurrence, geographic location in India and Geology of some important mineral deposits including coal and petroleum.

SYLLABUS

GL 1431: GEOLOGY IV: STRATIGRAPHY, PALEONTOLOGY AND ECONOMIC GEOLOGY

Unit–I Stratigraphy – its contents, basic principles, uniformitarianism, super position, lateral continuity, original horizontality, faunal succession, faunal assemblage. Geological time scale and basic time units – Eon, Era, Period, Epoch. **(6 Hours)**

Unit–II Major geological divisions of India – Brief study of stratigraphy of Kerala, Pre-Cambrian, Tertiary and Quaternary formations. **(6 Hours)**

Unit–III Paleontology – its branches, fossils, types of fossilization and uses of fossils. General morphological features of Brachiopods, Pelecypods, Gastropod and Arthropod. **(6 Hours)**

Unit–IV Economic Geology – Ore, gangue and industrial minerals. Brief study of important process of ore mineral formation. **(6 Hours)**

Unit–V Magmatism, hydrothermal processes, volcanism, contact metasomatism, metamorphism, evaporates, residual and mechanical concentration, supergene and sulphide enrichment. **(6 Hours)**

Unit–VI 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, Tamilnadu, Coal – Bokaro, Jharkhand, Petroleum – Naharkotiya, Assam and Bombay. **(6 Hours)**

PRACTICALS
First Semester B.Sc. Geography

Semester	Hours/Week	Hours/ Semester	Exam	Mark			Credits
				Internal	External	Total	
I, II, III & IV	2 Hours	36 Hours	Exam in IV Sem.	20	80	100	4

(Note: Practical sessions in First, Second, Third and Fourth semesters; Practical examination in Fourth semester)

COURSE OUTCOMES

CO 1: Understand, illustrate and draw diagrams related to rock cycle, hydrological cycle, subsurface groundwater occurrence, aquifer types and soil profile.

CO 2: Identify topographic and drainage features in topographic maps; identify megascopically rock forming and ore minerals by listing their salient properties.

CO 3: Prepare charts and diagrams of classification of rocks, block diagrams of structural features; work out simple problems in topographic maps, and determine attitude of beds from structural maps and interpret simple geological maps.

CO 4: Prepare chart of Geological Time Scale; prepare Mineral map of Kerala, Map of India showing locations of important mineral deposits and Geological map of Kerala; draw diagrams of simple fossils and identify megascopically common rocks.

GL 1432: Syllabus of Complementary Course – Practical I
Zero Credits **36 hours**

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

II. Preparation of diagram of typical soil profile.

Second Semester B.Sc. Geography

GL 1432: Syllabus of Complementary Course – Practical II
Zero Credits **36 hours**

I. Exercises in identification of salient topographic and drainage features using topographic maps. 1:50000 or 1:25000 Survey of India Toposheets.
II. Megascopic identification of rock forming minerals and ore minerals listed in the theory part of the syllabus.

Third Semester B.Sc. Geography

GL 1432: Syllabus of Complementary Course – Practical III
Zero Credits **36 hours**

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

Fourth Semester B.Sc. Geography

GL 1432: Syllabus of Complementary Course – Practical IV
Four Credits **36 hours**

I. 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.
II. Geological map of Kerala showing distribution of major stratigraphic units.
III. Diagram of a shell of a typical brachiopod, pelecypod, gastropod, ammonite and trilobite.
IV. Megascopic identification of rocks listed in the theory part of the concerned units.

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