



AVS

COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

Attur Main Road, Ramalingapuram, Salem - 106.

(Recognized under section 2(f) & 12(B) of UGC Act 1956 and
Accredited by NAAC with 'A' Grade)

(Co - Educational Institution | Affiliated to Periyar University, Salem
ISO 9001 : 2015 Certified Institution)

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Syllabus for

B. Sc GEOLOGY

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK

(CBCS – LOCF)

(Applicable to the Candidates admitted from 2023-24 onwards)

VISION

- To attain excellence in the field of education by creating competent scholars with a touch of human values.

MISSION

- To accomplish eminence in the academic domain.
- To provide updated infrastructure.
- To educate value based education.
- To impart skills through efficient training programs.
- To cultivate culture and tradition with discipline and determination.

REGULATIONS

1. Eligibility for Admission:

Candidates for admission to the first year of the Degree of Bachelor of science, Geology course are required to have passed the Higher Secondary Examination (Academic Stream) conducted by the Government of Tamil Nadu or an examination as equivalent to 10 +2 courses including CBSE, which have been recognized by the Periyar University. The candidates for admission to the Geology shall have passed the qualifying Examination with the subjects under physics and chemistry as compulsory subjects. For admission of students in the Government/Aided/ Unaided Colleges of Arts and Science, guidelines issued by the Director of Collegiate Education, Chennai– 6 may be followed.

2. Duration:

The course shall extend over a period of three years comprising of six semesters with Two semesters in one academic year. There shall not be less than 90 working days for each Semester. Examination shall be conducted at the end of every semester for the respective Subjects.

3. Eligibility for award of degree:

B.Sc. in Visual Communication is a 3-year full-time undergraduate course, the minimum eligibility for admission to which is the successful completion of the Senior Secondary Certificate (10+2) or 10+3 year Diploma qualification from a recognized educational board, With a minimum required eligibility prescribed by the University. The program is spread over 3 years, divided into 6 semesters of 6 months each The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

5. Scheme of Examination:

The theory examination shall be three hours duration to each paper at the end of each semester. the candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination. The practical examinations for UG course should be conducted at the end of the even semester

6. Passing Rules:

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed in First Class. All other successful candidates shall be declared to have passed in Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed in First Class with Distinction provide they pass all the examinations prescribed for the course at first appearance.

i) Theory

The candidate shall be declared to have passed the examination if the candidate secure not less than 40 marks out of 100 (CIA – 10 marks out of 25 and EA – 30 marks out of 75) in the Examination in each theory paper.

ii) Practical

The candidate shall be declared to have passed the examination if the candidate secure not less than 40 marks put together out of 100 (CIA – 16 marks out of 40 and EA –24 marks out of 60) in the University examination in each practical paper.

Programme Outcomes (POs)	
On successful completion of the B. Sc. Geology	
PO1	To develop an in-depth knowledge and skills in qualitative and quantitative research methods through laboratory, field and web modes of learning.
PO2	Recognize the need for sustainable use of earth resources, and value environmental, indigenous and other community perspective on geological activities.
PO3	Apply geological knowledge and critical thinking skills to identify a problem and to describe a strategy for handling.
PO4	Synthesize geological data on arrange of spatial and temporal scales to make interpretations that allow for scientific uncertainty.
PO5	Work effectively and professionally in multidisciplinary teams as a member and a leader and be able to manage and analyze complex ethical issues.

Program Specific Outcomes (PSOs)	
After the successful completion of B. Sc. Geology programme the students are expected to	
PSO1	Learn the essential properties of earth components, including its core, mantle, asthenosphere, lithosphere, cryosphere, hydrosphere, atmosphere and biosphere.
PSO2	Demonstrate mastery of the conceptual framework for understanding earth system processes and the development of earth's features over time.
PSO3	Acquiring geologic data in the field, laboratory, satellites and big data from data banks, Analyzing and interpreting the data through application of scientific method.
PSO4	Enable to apply successfully advanced and current concepts and methods of the geosciences to formulate and solve complex geological problems.
PSO5	Apply knowledge and techniques from allied fields, including chemistry, physics, biology, mathematics, and computing, to solve geological problems.
PSO6	Capable of understanding the impact of a geo-engineering solution in global and societal context.
PSO7	Students take-up a geologic problem and utilize theoretical, analytical or experimental approach to solve the problem through their project work. The students will be able to defend their project in an open forum.

Programme Educational Objectives (PEOs)

The B. Sc. Geology programme describes accomplishments that graduates are expected to attain within five to seven years after graduation.

PEO1	To demonstrate an understanding of the fundamental principles, concepts in theoretical and practical knowledge of the geological Science.
PEO2	An ability to recognize, evaluates, interpret, and understand issues and opportunities at the frontiers of geological domain.
PEO3	Ability to apply the basic knowledge of geology to real-life problems besides the use of computational and mathematical knowledge and tools.
PEO4	Work ethically and professionally alone and as part of a team, complying with applicable legislation and managing time and other resources efficiently and effectively and manage, execute their geological plans to meet desired goals realistic constraints.
PEO5	Communicate geological information concisely and accurately using written, visual, and verbal means appropriate to the situation.

CREDIT DISTRIBUTION FOR 3 YEARS B. Sc. GEOLOGY PROGRAMME

Part	Course Type	Credits per Course	No. of Papers	Total Credits
Part I	Language – I (Tamil/Hindi/French)	3	4	12
Part II	Language – II (English)	3	4	12
Part III	Core Courses- Theory	4	7	28
		5	6	30
	Core Courses- Practical	5	2	10
		3	2	6
	Major Elective Courses- Theory	3	2	6
	Allied Courses - Theory	3	4	12
	Allied Courses - Practical	1	2	2
	Allied Courses - Practical	3	1	3
Total				121
Part IV	Non Major Elective Courses	2	2	4
	Skill Enhancement Courses	2	4	8
		1	1	1
	Foundation Course	2	1	2
	EVS (Environmental Studies)	2	1	2
	Value Education	2	1	2
	Internship/ Field Visit/Industrial visit	2	1	2
	Professional Competency Skill	2	1	2
Extension Activity (NSS/NCC/Physical Education)	1	1	1	
Total				24
Total Credits				145

**CONSOLIDATED SEMESTER WISE AND COMPONENT WISE CREDIT DISTRIBUTION
FOR 3 YEARS B. Sc GEOLOGY PROGRAMME**

Parts	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	15	13	16	22	18	97
Part IV	4	4	3	6	4	3	24
Part V	-	-	-	-	-	-	-
Total	23	25	22	28	26	21	145

*Part I, II and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programmes and the other components IV and V have to completed during the duration of the programmes as per the norms, to be eligible for obtaining the UG degree.

METHOD OF EVALUATION

Evaluation	Components	Marks
Internal Evaluation	Continuous Internal Assessment Test	15
	Assignments	3
	Class Participation	2
	Distribution of marks for Attendance (in percentage) 96 – 100: 5 Marks 91 – 95: 4 Marks 86 – 90: 3 Marks 81 – 85: 2 Marks	5
External Evaluation	End Semester Examination	75 Marks
Total		100 Marks

Note: 1.UG Programmes- A candidate must score minimum 10 marks in Internal and 30 marks in External Evaluation.

CONTINUOUS INTERNAL ASSESSMENT

Categorizing Outcome Assessment Levels Using Bloom's Taxonomy

level	Cognitive Domain	Description
K1	Remember	It is the ability to remember the previously learned concepts or ideas.
K2	Understand	The learner explains concepts or ideas.
K3	Apply	The learner uses existing knowledge in new contexts.
K4	Analyze	The learner is expected to draw relations among ideas and to compare and contrast.
K5	Evaluate	The learner makes judgments based on sound analysis.
K6	Create	The learner creates something unique or original.

Question Paper Blue Print for Continuous Internal Assessment- I & II

Duration: 2 Hours		Maximum: 50 marks					
Section	K level						Marks
	K1	K2	K3	K4	K5	K6	
A (no choice)	10						10 X 1 =10
B (no choice)		1	1				2 X 5 =10
C (either or choice)				3			3 x 10 = 30
Total							50 marks

Note: K4 and K5 levels will be assessed in the Model Examination whereas K5 and K6 Levels will be assessed in the End Semester Examinations.

Question Paper Blue Print for Continuous Internal Assessment- I

Time: 2 Hours

Total Marks: 50 Marks

Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
I	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
I or II	-	-	Q.N. 14 A, 14 B
II	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

SECTION – A (10 X 1 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – C (3 X 10 = 30 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Continuous Internal Assessment- II

Time: 2 Hours

Total Marks: 50 Marks

Minimum Pass: 20 Marks

Unit	Section - A	Section - B	Section - C
III	Q.N. 1, 2, 3, 4, 5	Q.N. 11	Q.N. 13 A, 13 B
III or IV	-	-	Q.N. 14 A, 14 B
IV	Q.N. 6, 7, 8, 9, 10	Q.N. 12	Q.N. 15 A, 15 B

SECTION – A (10 X 1 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ALL THE QUESTIONS

SECTION – C (3 X 10 = 30 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Model Examination & End Semester Examination

Duration: 3 Hours		Maximum: 75 marks						
Section	K level						Marks	
	K1	K2	K3	K4	K5	K6		
A (no choice, three questions from each unit)		15						15 X 1 =15
B (choice, one question from each unit)			1	1				2 X 5 =10
C (either or choice & two questions from each unit)	<i>Courses with K4 as the highest cognitive level</i>				4	1		5 x 10 = 50
	<i>Course with K5 as the highest cognitive level wherein three K4 questions and two K5 questions are compulsory.</i>				3	2		
	<i>Course with K6 as the highest cognitive level wherein two questions each on K4, K5 and one question on K6 are compulsory.</i>				2	2	1	
Total								75 marks

Question Paper Blue Print for Model Examination & End Semester Examination

Time: 2 Hours

Total Marks: 75 Marks

Minimum Pass: 30 Marks

Unit	Section - A	Section - B	Section - C
I	Q.N. 1, 2, 3	Q.N. 16	Q.N. 21 A, 21 B
II	Q.N. 4, 5, 6	Q.N. 17	Q.N. 22 A, 22 B
III	Q.N. 7, 8, 9	Q.N. 18	Q.N. 23 A, 23 B
IV	Q.N. 10, 11, 12	Q.N. 19	Q.N. 24 A, 24 B
V	Q.N. 13, 14, 15	Q.N. 20	Q.N. 25 A, 25 B

SECTION – A (15 X 1 = 15 Marks)

ANSWER ALL THE QUESTIONS

SECTION – B (2 X 5 = 10 Marks)

ANSWER ANY TWO QUESTIONS

SECTION – C (5 X 10 = 50 Marks)

ANSWER ALL THE QUESTIONS (Either or Choice)

Question Paper Blue Print for Model Practical Examination & End Semester Examination (Practical)

Time: 3 Hours

Total Marks: 60 Marks

Minimum Pass: 24 Marks

Practical Marks	Maximum Mark	Minimum Mark
Internal	40	16
External	60	24
Total	100	40

Evaluation for End Semester Examinations (Practical)

Record	10 marks
Formula with expansion	05 marks
Observation with data	20 marks
Viva-voce	05 marks
Calculation	15 marks
Result with units	05 marks
TOTAL	60 MARKS

*Submission of record with due certification is a must for external practical examinations.

**A student should complete all requires experiments to get 10 marks for the record.

Scheme of Examination for B. Sc Geology

First Year – Semester - I

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA01	Podhu Tamil - I	6	3	25	75	100
II	23UFEN01	General English - I	6	3	25	75	100
III	23UGECT01	Core I - General Geology and Crystallography	5	5	25	75	100
III	23UGECT02	Core II - Geo-Statistics	5	5	25	75	100
III	23UCHGEA01	Allied - Chemistry For Physical Science - I	4	3	25	75	100
IV	23UGEFC01	Foundation Course - Understanding the earth.	2	2	25	75	100
IV	23UTANE01	Non Major Elective Course - Pechukalai Thiran	2	2	25	75	100
Total			30	23			

First Year – Semester - II

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA02	Podhu Tamil - II	6	3	25	75	100
II	23UFEN02	General English - II	6	3	25	75	100
III	23UGECT03	Core III - Palaeontology	5	5	25	75	100
III	23UGECP01	Core Practical I - Crystallography and Palaeontology	5	5	40	60	100
III	23UCHGEA02	Allied - Chemistry For Physical Sciences - II	4	3	25	75	100
III	23UCHGAP01	Allied Practical I - Chemistry For Physical Sciences - I	3	1	40	60	100
III	23UCHGAP02	Allied Practical II - Chemistry For Physical Sciences – II	3	1	40	60	100
IV	23UGEFC02	Foundation Course - Basics of Earth Science	2	2	25	75	100
IV	23UVCNP01	Non Major Elective Course - Basic Photography	2	2	25	75	100
Total			33	25			

Second Year – Semester - III

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA03	Podhu Tamil - III	6	3	25	75	100
II	23UFEN03	General English - III	6	3	25	75	100
III	23UGECT04	Core IV- Mining Geology	5	5	25	75	100
III	23UGECT05	Core V - Geomorphology and Geotectonics	5	5	25	75	100
III	23UPHA01	Allied III - Allied Physics – I	4	3	25	75	100
IV	23UGESO02	Skill Enhancement Course - Entrepreneurial Based - Principles of surveying.	1	1	25	75	100
IV	23UGESO05	Skill Enhancement Course - Geohazards	2	2	25	75	100
IV		E.V.S	1	-	-	-	-
Total			30	22			

Second Year – Semester - IV

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
I	23UFTA04	Podhu Tamil - IV	6	3	25	75	100
II	23UFEN04	General English - IV	6	3	25	75	100
III	23UGECT06	Core VI - Structural Geology & Photogeology	5	5	25	75	100
III	23UGECP02	Core Practical II - Structural Geology, Remote Sensing, Survey Practical	5	5	40	60	100
III	23UPHA02	Allied - IV - Allied Physics - II	3	3	25	75	100
III	23UPHAP01	Allied Practical II - Allied Physics Practical - I	3	3	40	60	100
IV	23UGESO04	Skill Enhancement Course - Field Hydrogeology and Techniques	2	2	25	75	100
IV	23UGESO05	Skill Enhancement Course – Geo-heritage and Geo-tourism	2	2	25	75	100
IV		E.V.S	1	2	25	75	100
Total			33	28			

Third Year – Semester - V

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
III	23UGECT07	Core VII - Stratigraphy	5	4	25	75	100
III	23UGECT08	Core VIII - Mineralogy	5	4	25	75	100
III	23UGECT09	Core IX - Igneous Petrology	5	4	25	75	100
III	23UGECT10	Core X - Sedimentary and Metamorphic Petrology	5	4	25	75	100
III	23UGEEM01	Elective V- Hydrogeology	4	3	25	75	100
	23UGEEM02	Elective VII - Remote sensing & GIS	4	3	25	75	100
IV		Value Education	2	2	25	75	100
IV		Internship / Industrial Visit / Field Visit		2			
Total			30	26			

Third Year – Semester – VI

Part	Course Code	Course Title	Ins. Hrs	Credit	CIA	ESE	Total
III	23UGECT11	Core XI - Regional Geology	6	4	25	75	100
III	23UGECT12	Core XII - Economic Geology and Mineral Economics	6	4	25	75	100
III	23UGECT13	Core XIII - Applied Geology	6	4	25	75	100
III	23UGECP03	Core Practical III - Mineralogy and Petrology practical	5	3	40	60	100
III	23UGECP04	Core Practical IV - Economic geology and Ore analysis practical	5	3	40	60	100
IV		Extension Activity	-	1	-	-	-
IV		Professional Competency Skill	2	2	25	25	
Total			30	21			

****Ins. Hrs** – Instructional Hours, **CIA**- Continuous Internal Assessment, **ESE**- End Semester Examination

Semester: I	Course Code: 23UGECT01	Hours/Week: 5	Credit:5
COURSE TITLE: CORE I - GENERAL GEOLOGY AND CRYSTALLOGRAPHY			

Course Overview:

1. This course covers a comprehensive exploration of the cosmos, starting with the evolution of the universe and progressing through the formation of stellar systems, including our Milky Way Galaxy. Delving into the solar system, it examines the inner and outer planets, detailing their characteristics.
2. The study extends to various celestial bodies like satellites, asteroids, meteors, and comets.
3. Moving closer to home, the Earth's movements, such as revolution and rotation, as well as celestial events like solstices and equinoxes, are discussed. Time standards, including GMT and IST, are explained.
4. The course also delves into Earth's dynamic components, encompassing the atmosphere, monsoons, El Niño, hydrosphere, and lithosphere.
5. The origin of the Earth is explored through theories like the Nebular and Planetesimal hypotheses, along with Tidal and Vonweizacker's hypotheses.

Learning Objectives:

1. The main objective of this course is to enumerate the origin of Earth.
2. To describe the concepts of Dating and internal structure of the Earth
3. To explain various components of crystals and crystallography
4. To study various class and forms of an crystal system.
5. To determine various crystallographic properties of crystals with suitable examples.

Unit - I	Evolution of the Universe	09 Hours
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Universe – Evolution of the Universe – Stellar system

Milky Way Galaxy

Evolution of Galaxy.

Solar System – Inner and outer planets – characteristics of solar system.

Satellites – Asteroids – Meteors – comets. Earth – movements – revolution

Rotation – solstice – equinox – time – GMT – IST.

Atmosphere – Monsoon- El Nino

Hydrosphere – lithosphere.

Origin of the Earth – Nebular and Planetesimal hypothesis

Tidal & Vonweizacker’s hypothesis

Merits and demerits of the above hypotheses

Unit - II	Age of the Earth	09 Hours
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Age of the Earth – old methods – new methods

Radioactivity – Half-life period – Radiometric methods

Uranium / Lead method – Rubidium / Strontium method

Lead / Lead method – Potassium/Argon -Carbon 14 method.

Numerical methods in dating.

Interior of the Earth – Density – Shape – Seismic waves

Composition and thickness of the crust, mantle and core.

Discontinuities: Conrad Discontinuity – Mohorovicic Discontinuity

Weichert-Guttenberg Discontinuity

Unit - III	Crystallography	09 Hours
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Definition of crystal – Unit cell, Bravais Lattices, Plane groups,

Point groups & Space groups

Crystallographic axes – Symmetry Elements – Division of crystals into systems and

Point groups Axial Ratio – Parameters – Indices – Miller Indices – Symbol

Hermann Mauguin-notations

Law of Rational Indices – Forms – simple – combination – open – closed – unit

holohedral – hemihedral – tetrahedral – hemimorphic – enantiomorphous forms

Interfacial angle and its measurement with Contact Goniometer. Types of Goniometers

Unit - IV	Study of common Crystal forms	09 Hours
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Study of common forms and combinations of the following systems and classes:

Isometric System: Hexoctahedral, Diploidal, Hextetrahedral

Tetragonal System: Ditetragonal bipyramidal, Tetragonal bipyramidal,

Tetragonal Pyramidal, Tetragonal Sphenoidal

Hexagonal System: Dihexagonal Bipyramidal, Hexagonal Bipyramidal Trigonal System

Ditrigonal Scalenohedral

Ditrigonal pyramidal, Trirhombohedral, Trigonaltrapezohedral.

Unit - V	Twinning Crystals	09 Hours
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Study of common forms and combinations of the following systems and classes:

Orthorhombic System: Rhombic Bipyramidal, Rhombic pyramidal,

Rhombic Disphenoidal.

Monoclinic System: Prismatic

Triclinic System: Pinacoidal

Twinning in crystals

Laws of twinning – types: contact, interpenetration, polysynthetic,
repeated – important examples from six systems

Irregularities of crystals-An introduction to stereographic projection.

Text Book(s):

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Patwardhan, A.M., Dynamic Earth System, Prentice Hall, New Delhi(1999)
4. Mukherjee A.K, Principles of Geology, EW Press, Kolkata (1990)
5. Reed, J.S. &T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005)

Reference Books:

1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA.
2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributors, New Delhi.
3. Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer
5. Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)

Web Resources:

1. "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.
2. Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem

(mostly) solved". Special Publications, Geological Society of London.

3. Geo.libretexts.org
4. www.nationalgeographic.org
5. Solarsystem.nasa.gov.

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the origin of Galaxy, Our Solar System and Crystal Science	K1
CO2	Knowledge on Dating of Earth Age	K2
CO3	Correlate various Hypothesis on Origin of Earth	K3
CO4	Analyze the importance of Crystallography Studies	K4
CO5	Various Type minerals and their respective crystal system	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: I	Course Code: 23UGECT02	Hours/Week: 5	Credit: 5
COURSE TITLE: CORE II GEO-STATISTICS			

Course Overview:

1. Statistics is a branch of mathematics that deals with the collection, analysis, interpretation, presentation, and organization of data.
2. It provides methods for making inferences about the characteristics of a population based on a sample.
3. Tabulation involves systematically arranging data in rows and columns, providing a concise and organized summary for easy analysis.
4. Frequency distribution is a table that shows the number of occurrences of different values in a dataset, grouped into intervals.
5. This course overview covers fundamental statistical concepts, from data organization and representation to measures of dispersion, correlation, and regression. It equips students with tools to analyze and interpret data in various forms.

Learning Objectives:

1. The main objective of this course is to importance of statistics in science.
2. To describe the concepts of basic statistics
3. To explain various components of advanced statistical methods
4. To study various graphical methods and its applications
To determine various correlation and regression studies and its importance in the field of
5. Geology

Unit - I	Introduction to Geostatistics	09 Hours
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Definition and scope of statistics

Tabulation of data

Formation of Frequency Distribution

Diagrammatic representation of data-Bar diagrams

Pie diagrams-Graphic Representation of data

Histogram, Frequency polygon

Ogives

Unit - II	Calculation of Mean, Median, Mode	09 Hours
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Arithmetic Mean Median, Mode, Combined arithmetic mean
Merits and demerits.

Unit - III	Measures of Dispersion	09 Hours
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Measures of Dispersion
Absolute and Relative measures Range, Quartile deviation,
Mean deviation, Standard deviation

Unit - IV	Method of Least square	09 Hours
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Cure fitting by the Method of Least square
Fitting straight line of the form $Y = ax + b$ and
parabola $Y = a x^2 + b x + c$ (Simple problems)

Unit - V	Correlation	09 Hours
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Correlation
Karl person's coefficient of correlation, Rank correlation
Spearman's Rank correlation coefficient
Reregression - regression equation and their properties

Text Book(s):

1. Statistics – R.S.N. Pillai and V. Bhagavathi, Publications. Chand.
2. Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons Pvt Ltd, New Delhi, s5th Revised Edition.
3. Statistics for Geoscientists - Marsal, D. Pergamon press, New York.
4. Cline, Graysen (2019). Nonparametric Statistical Methods Using R. EDTECH. ISBN 978-1-83947-325-8. OCLC 1132348139. Archived from the original on 2022-05-15. Retrieved 2021-09-16.
5. Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-314-03309-3

Reference Books:

1. Statistics for Geoscientists - Marsal, D. Pergamon press, New York.
2. Statistics – R.S.N. Pillai and V. Bhagavathi, Publications. Chand.

3. Statistical Methods, Gupta, S.P. (2007): sultan Chand & sons Pvt Ltd, New Delhi, 5th Revised Edition.
4. Cline, Graysen (2019). Nonparametric Statistical Methods Using R. EDTECH. ISBN 978-1-83947-325-8. OCLC 1132348139. Archived from the original on 2022-05-15. Retrieved 2021-09-16.
5. Anderson, D.R.; Sweeney, D.J.; Williams, T.A. (1994) Introduction to Statistics: Concepts and Applications, pp. 5–9. West Group. ISBN 978-0-314-03309-3

Web Resources:

1. <https://en.wikipedia.org/wiki/Statistics>
2. <http://onlinestatbook.com/2/introduction/descriptive.html>
3. https://en.wikipedia.org/wiki/Descriptive_statistics

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	To describe the definition, scope, classification, tabulation, drawing diagrams and plotting graphs of Statistics through Geological information.	K1
CO2	To measure and interpret the various measures of averages using Geological data.	K2
CO3	To measure and interpret the various measures of dispersions using Geological data.	K3
CO4	To measure and interpret the relationship among the geological variables and to estimate and predict the unknown and future value through the regression lines using geological data.	K4
CO5	To fit the curve using geological data.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: I	Course Code: 23UGFC01	Hours/Week: 2	Credit: 2
COURSE TITLE: FOUNDATION COURSE - UNDERSTANDING THE EARTH			

Course Overview:

1. This course provides a comprehensive understanding of planet Earth and the broader cosmos. Topics include astronomy, exploring the origin and characteristics of the Universe, Solar System, and its planets, distinguishing between terrestrial and jovian planets, and examining meteorites and asteroids.
2. The study delves into Earth's position in the solar system, covering its origin, size, shape, mass, density, rotational and revolution parameters, and age
3. Additionally, it explores plate tectonics, sea-floor spreading, continental drift, mid-oceanic ridges, and trenches, transform faults, island arcs, the origin of oceans, continents, mountains, rift valleys, earthquakes, and volcanoes.
4. Further discussions revolve around the distribution of elements in the solar system and Earth, chemical differentiation, composition of Earth, geochemical cycles, and mass balance.
5. The course also explores the properties and geochemical behavior of major elements, providing a comprehensive overview of Earth's dynamic systems and processes.

Learning Objectives:

1. The main objective of this course is to understand various properties of Earth.
2. To describe the concepts of internal structure of the Earth
3. To explain various components related to external processes of Earth
4. To study concepts of various currents and atmospheric circulation.
5. To understand the availability of elements in the Earth.

Unit - I	Understanding of planet Earth	09 Hours
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Understanding of planet Earth: Astronomy, Geology, Meteorology and Oceanography.

General characteristics and origin of the Universe, Solar System and its planets.

The terrestrial and jovian planets.

Meteorites and Asteroids Earth in the solar system

Origin, size, shape, mass, density, rotational and revolution parameters and its age.

Unit - II	Earth Internal structure	09 Hours
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External Structure: hydrosphere, atmosphere and biosphere.

Earth's magnetic field.

Unit - III	Continental Drift	09 Hours
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Plate tectonics

Sea-floor spreading and continental drift

Mid Oceanic Ridges, trenches

Transform faults and island arcs Origin of oceans, continents, mountains and rift valleys

Earthquake and Volcanoes.

Unit - IV	Weather and climatic changes	09 Hours
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Concepts of eustasy;

Land-air-sea interaction Oceanic current system and effect of Coriolis force;

Wave erosion and beach processes

Atmospheric circulation

Weather and climatic changes.

Unit - V	Properties of elements	09 Hours
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Distribution of elements in solar system and in Earth;

Chemical differentiation and composition of the Earth

General concepts about geochemical cycles and mass balance

Properties of elements

Geochemical behavior of major elements

Mass conservation of elements and isotopic fractionation.

Text Book(s):

1. Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis.
2. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment. Cambridge University Press.
3. Patwardhan, A.M., Dynamic Earth System, Prentice Hall, New Delhi(1999)
4. Mukherjee A.K, Principles of Geology, EW Press, Kolkata(1990)
5. Reed, J.S. & T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005)

Reference Books:

1. Gross, M. G. (1977). Oceanography: A view of the earth.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Crystals and Crystal Structures – Richard J. D. Tilley (2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer
5. Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)

Web Resources:

1. "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.
2. Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.
3. Geo.libretexts.org
4. www.nationalgeographic.org
5. Solarsystem.nasa.gov

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the properties of Earth	K1
CO2	Knowledge on Dating of Earth Age	K2
CO3	Correlate various Hypothesis on Origin of Earth	K3
CO4	Analyze the importance of Crystallography Studies	K4
CO5	Various Type minerals and their respective crystal system	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3- Strong, 2 – Medium, 1 – Low

Semester: II	Course Code: 23UGECT03	Hours/Week: 5	Credit: 5
COURSE TITLE: CORE III - PALAEOLOGY			

Course Overview:

1. Fossils are preserved remains or traces of ancient organisms. Conditions for fossilization include rapid burial, anaerobic environments, and mineralization.
2. Preservation modes include petrification, molds, and casts. Fossils aid in paleontological research, dating, and understanding evolutionary history.
3. Geological time scale categorizes Earth's history into eons, eras, periods, epochs. Mollusca, a diverse phylum, include classes Pelecypoda (bivalves), Gastropoda (snails), and Cephalopoda (cephalopods). Cephalopoda further divides into orders Nautiloidea, Ammonoidea, and Dibranchia (Belemnites).
4. Arthropoda's Class Trilobita and Echinodermata's Classes Echinoidea, Crinoidea, and Blastodea contribute to Earth's paleontological diversity.
5. Paleobotany explores ancient plant life, including Gondwana Flora.

Learning Objectives:

1. Understand the basics of Fossils
2. Understand the importance of fossils in Geological studies
3. Know different phylum and their species with morphological changes
4. Understand and correlate fossil with various rock formations
5. Understand the importance of Palaeontology in dating and evolution studies

Unit - I	Introduction to Fossil	09 Hours
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Fossils –Definition

Conditions required for fossilization-

Modes of preservation

Uses of fossils

Geological time scale

Unit - II	Classification of Phylum	09 Hours
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The morphology and geological distribution of Mollusca

Classes, Pelecypoda, Gastropoda, Cephalopoda

Orders - Nautiloidea, Ammonoidea, Dibranchia – Belemnites.

Unit - III	Classification of Phylum	09 Hours
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Phylum – Brachiopoda, Phylum Coelenterata

Class: Anthozoa – Subclass: Zoantharia Orders: Rugosa, Tabulata and Scaleractina.

Phylum – Hemichordata

Class: Graptozoa, order Dendroidea, Order Graptolitoidea.

Unit - IV	Classification of Phylum	09 Hours
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Phylum – Arthropoda Class: Trilobita

Phylum – Echinodermata Class: Echinoidea Class – Crinoidea

Class: Blastoidea

Introduction to Paleobotany, Gondwana Flora

Unit - V	Dinosaurs	09 Hours
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Short account of the following Dinosaurs

Saurischian Dinosaur and Ornithistian Dinosaurs

Archaeopteryx

Elementary idea of Vertebrate fossils of India,

Morphological character of Phylum - Protozoa, Order – Foraminifera

Text Book(s):

1. Palaeontology Evolution and animal distribution. .C. Jain and M.S. Anantharaman, (1996), Vishal Publications, Jalandhar.
2. Invertebrate Palaeontology - H.Woods, (1985), CBS Publishers and Distributors, New Delhi.
3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995)
4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D(2005)
5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).

Reference Books:

1. Principles of Invertebrate Palaeontology, Shrock R.R and Twenohofel W.H, (2005), CBS Publishers and Distributors, New Delhi.
2. Invertebrate Fossils. Moore R.C, Lalicker C.G and Fisher A.G (1952) McGraw Hill.
3. The Vertebrate Story, Romer A.S, (1959) University of Chicago Press, 4thEdt. Chicago.
4. Palaeontology an Introduction, E.W. Nield and V.C.T. Tucker (1985) Pergamon Press, Oxford.
5. Colbert E.H. et al., Evolution of the Vertebrates, Wiley. New Delhi 2002)

Web Resources:

1. "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.
2. Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.
3. Digitalatlas.cose.ISU.edu>geo>basics>fossil
4. www.sciencedirect.com>topic>hemichordata
5. w.qm.qid.au>biodiscovery>corals

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the basics of Fossils	K1
CO2	Understand the importance of fossils in Geological studies	K2
CO3	Know different phylum and their species with morphological changes	K3
CO4	Understand and correlate fossil with various rock formations	K4
CO5	Understand the importance of Paleontology in dating and evolution studies	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1– Low

Semester: II	Course Code: 23UGCEP01	Hours/Week:5	Credit: 5
COURSE TITLE: CORE PRACTICAL I - CRYSTALLOGRAPHY & PALEONTOLOGY PRACTICAL			

Course Overview:

1. This course delves into the intricate world of minerals and crystallography, providing a comprehensive understanding of their classifications and unique structures.
2. The syllabus covers crystal systems, including isometric, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic, with detailed insights into representative minerals for each system.
3. Module 1: Isometric System Module 2: Tetragonal System Module 3: Hexagonal System
4. Module 4: Orthorhombic System Module 5: Monoclinic System Module 6: Triclinic System Module 7: Twin Crystals
5. This course provides a solid foundation for understanding the diverse world of minerals, their crystal structures, and the fascinating phenomena of twin crystals.

Learning Objectives:

1. The main objective of this course is to enumerate the origin of Earth.
2. To describe the concepts of Dating and internal structure of the Earth
3. To explain various components of crystals and crystallography
4. To study various class and forms of an crystal system.
5. To determine various crystallographic properties of crystals with suitable examples.

Unit - I	Crystal System	12 Hours
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Isometric System: Normal Class – Galena, Fluorite, Magnetite, Garnet, and Leucite, Copper

Pyritohedral class – Pyrite, Tetrahedral Class – Tetrahedrite.

Tetragonal System: Normal Class – Zircon, Vesuvianite, Cassiterite, and Rutile.

Tripyramidal – Scheelite, Meionite Sphenoidal Class – Chalcopyrite.

Hexagonal System: Normal Class – Beryl, Tripyramidal – Apatite,

Hemimorphic – Zincite, Rhombohedral Normal – Calcite, Trapezohedral Class – Quartz.

Unit - II	Crystal System	12 Hours
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Orthorhombic System: Normal – Barite, Sulphur, Stibnite, Topaz, Staurolite, and Aragonite.

Hemimorphic – Calymene, Sphenoidal Class – Epsomite.

Monoclinic System: Normal – Gypsum, Pyroxenes and Amphiboles.

Triclinic System: Normal – Axinite, Albite, and Rhodonite.

Twin Crystals: Contact and Penetration twins of Fluorite, Iron Cross Twin of Pyrite,
Knee type twin of Cassiterite,

Polysynthetic twin of Aragonite, Cyclic twin of Cerussite, Swallow Tail of Gypsum,

Twins of Carlsbad, Baveno, Manebach, Albite law of Albite.

Unit - III	Identification of Fossils	12 Hours
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Identification and description of the following fossils:

Lamellibranchs: Arca, Meretrix, Pecten, Cardita, Lima, Allectronia, Inoceramus,
Gryphaea, Exogyra, Radiolites, Ostrea, Unio, Trigonia.

Gastropods: Turritella, Turbo, Cerithium, Trochus, Physa, Murex, Voluta, Helix,
Euomphalus, Cyprea.

Unit - IV	Identification of Fossils	12 Hours
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Cephalopods: Nautilus, Orthoceras, Ceratite, Goniatite, Belemnites, Baculites, and Perisphinctes.

Echinodermata: Cidaris, Holaster, Hemiaster, Stigmatophygus, Apiocrinus.

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

Unit - V	Identification of Fossils	12 Hours
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Corals: Calceola, Zaphrentis, Lithostrotion, Omphyma, Thecosmelia.

Brachiopoda: Terebratula, Spirifer, Productus, Monograptus, Tetragraptus, Diplograptus.

Text Book(s):

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Agashe, S.N, Paleo botany, Oxford & IBH. Delhi(1995)
4. Stewart W.N. & G.W. Rothwell, Palaeobotany, Cambridge University Press. D (2005)
5. Moore R.C. et al., Invertebrate Fossils. CBS. Delhi (1952).

Reference Books:

1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York. USA.
2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributors, New Delhi.

3. Crystals and Crystal Structures – Richard J. D. Tilley(2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer
5. Colbert E.H. et al., Evolution of the Vertebrates, Wiley. New Delhi (2002)

Web Resources:

1. Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.
2. Digitalatlas.cose.ISU.edu>geo>basics>fossil
3. www.sciencedirect.com>topic>hemichordata

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	The main objective of this course is to enumerate the fundamental aspects of Mineralogy in such a way as to stimulate the minds of the post-graduate students.	K1
CO2	To describe the concepts of Mineralogy is essential to comprehend the concepts of Petrology.	K2
CO3	To explain the importance of instrumentation techniques for better analysis	K3
CO4	To compare and contrast between the fascinating plethora of colorful minerals and crystals, this discipline requires good knowledge of Chemistry, and poses several intriguing questions, leading to sustained interest in this subject	K4
CO5	Can evaluate the accuracy and summaries the methods adapted for certain practical activities.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: II	Course Code: 23UGFC02	Hours/Week: 2	Credit: 2
COURSE TITLE: FOUNDATION COURSE - BASICS OF EARTH SCIENCE			

Course Overview:

1. The course covers fundamental aspects of Earth science and the Universe.
2. It explores the evolution of the Universe, characteristics of the Solar System including inner and outer planets, satellites, asteroids, meteors, and comets.
3. Key Earth movements such as revolution, rotation, solstice, and equinox are examined.
4. In the context of geology, the course delves into environmental impacts arising from mining and mineral processing.
5. Additionally, the course covers Fossil Fuels and Groundwater, providing a comprehensive overview of these geological components and their applications.

Learning Objectives:

1. The main objective of this course is to understand various properties of Earth.
2. To describe the concepts of internal structure of the Earth
3. To explain various components related to external processes of Earth
4. To study concepts of various currents and atmospheric circulation.
5. To understand the availability of elements in the Earth.

Unit - I	Evolution of the Universe	09 Hours
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Universe – Evolution of the Universe.

Solar System – Inner and outer planets ,

Characteristics of solar system.

Satellites – Asteroids – Meteors – comets.

Earth – movements – revolution – rotation – solstice – equinox.

Atmosphere - El Nino – hydrosphere – lithosphere- Origin of the Earth.

Unit - II	Age of the Earth	09 Hours
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Age of the Earth - old methods – new methods ,

Radioactivity – Half-life period – Radiometric methods.

Interior of the Earth – Density – Shape

Seismic waves

Composition and thickness of the crust, mantle and core.

Discontinuities: Conrad Discontinuity – Mohorovicic Discontinuity.

Unit - III	Introduction to Geomorphology	09 Hours
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Introduction to Geomorphology: Geological action of wind, water, Glaciers and ground water.

Volcanoes and earthquakes.

Rock deformation: Folds, Faults, Joints, Cleavage, Unconformities

Concepts of plate tectonics

Sea floor spreading and geosynclines.

Unit - IV	Study of Fossils	09 Hours
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Study of Fossils- Introduction, Geological Record and its nature.

Geological Time Scale.

Introduction, Definition of Paleontology, Classification of Plants,

Invertebrate and Vertebrate fossils.

Fossils - Toponymy (Burial Law), Types of Fossilization,

Mode of preservation.

Applications of Fossils– National fossil parks across India.

Unit - V	Applications of Geology	09 Hours
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Applications of Geology:

Environmental impacts due to mining and mineral process,

Engineering Geology: Dams, Reservoirs and Tunnels, strategic, critical and essential mineral

Mineral resources of India. Fossil Fuels and Groundwater.

Text Book(s):

1. Mineralogy – Dexter Perkins (2014), 3rd edition, Pearson New International Edition.
2. Principles of Geomorphology; William D. Thornbury, (2004) CBS Publishers and Distributors, New Delhi.
3. Patwardhan, A.M., Dynamic Earth System, Prentice Hall, New Delhi(1999)
4. Mukherjee A.K, Principles of Geology, EW Press, Kolkata(1990)
5. Reed, J.S. & T.H. Wicander, Essentials of Geology, McGraw Hill., New York(2005)

Reference Books:

1. Introduction to Mineralogy – William D. Nesse (2000), Oxford University press, New York, USA.
2. Textbook of Mineralogy – E.S. Dana, (2000), 3rd edition, CBS Publishers & Distributers, New Delhi.
3. Crystals and Crystal Structures – Richard J. D. Tilley (2006), John Wiley & Sons, England.
4. Introduction to Mineralogy, Crystallography & Petrology – Carl W. Correns (1967), 2nd edition, Springer
5. Radhakrishnan, V, General Geology, V.V.P. Publishers, Tuticorin (1996)

Web Resources:

1. "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 2006-01-10.
2. Dalrymple, G. Brent (2001). "The age of the Earth in the twentieth century: a problem (mostly) solved". Special Publications, Geological Society of London.
3. Geo.libretexts.org
4. www.nationalgeographic.org
5. Solarsystem.nasa.gov

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Gather basic information on Earth Sciences	K1
CO2	Understand the importance of various components of Earth	K2
CO3	Process of Geomorphological features	K3
CO4	Understand, predict and analyze the fossil and dating	K4
CO5	Apply the geological knowledge in various civil structures	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: II	Course Code: 23UGENE02	Hours/Week: 2	Credit: 2
COURSE TITLE: NON MAJOR ELECTIVE COURSE - OCEANOGRAPHY			

Course Overview:

1. Oceanography is the scientific study of the ocean and its phenomena. It encompasses various disciplines such as physical, chemical, biological, and geological oceanography.
2. Understanding the ocean is crucial for climate regulation, marine life sustainability, and economic activities. It also contributes to predicting natural disasters like tsunamis and hurricanes.
3. Surface Configuration of the Ocean Floor
4. Horizontal and Vertical Distribution of Seawater Temperature
5. Marine resources include fish, minerals, and energy sources. Their distribution impacts industries and ecosystems.

Learning Objectives:

1. Understand the basics of Ocean
2. Understand the importance of Major Ocean affecting factor
3. Know different group of factor using tides
4. Understand the descriptive types of ocean
5. Understand the importance of Resource of ocean

Unit - I	Structure of Ocean Floor	09 Hours
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Oceanography: Scope, Content, Significance

Distribution of Land and Sea

Hypsometric Curve

Surface Configuration of the Ocean Floor:

Oceanic Deeps and Submarine Canyons

Unit - II	Major Oceans	09 Hours
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Relief Features of the Major Oceans: Atlantic, Pacific and Indian Ocean

Horizontal and Vertical Distribution of Seawater Temperature.

Salinity: Factors Affecting Salinity and Distribution

Unit - III	Ocean Circulation	09 Hours
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Ocean Water Circulation: Factors Influencing Ocean Circulation

General Circulation of Ocean Currents

Currents of the Atlantic, Pacific and Indian Ocean, Waves and Tides:

Definition and Types, Tsunamis: Origin and Effects

Unit - IV	Ocean Ecology	09 Hours
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Marine Deposits: Classification and Distribution

Coral Reefs types

Conditions for the Growth

Unit - V	Marine Resources	09 Hours
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Marine Resources: Types

Distribution and Uses

Tidal Energy

Role of National Institute of Oceanography in India

Text Book(s):

1. Anikouchine, W. A. and Sternberg, R. W., (1973): The World Oceans - An Introduction to Oceanography, Englewood Cliffs.
2. Garrison, T., (1998): Oceanography, Wadsworth Co.USA
3. Gerald, S. (1980): General Oceanography: An Introduction, John Wiley & Sons, New York
4. King, C. A. M., (1972): Beaches and Coasts, E. Arnold, London: King, C. A. M.,(1975): Oceanography for Geographers, E. Arnold, London
5. Ramasamy, G., (1970): Oceanography (Tamil Edition), Tamil Nadu Text Book Society, Chennai

Reference Books:

1. Sharma, R. C. and Vatel, M., (1970): Oceanography for Geographers, Cheytanya Publishing House, Allahabad

Web Resources:

1. <https://www.uio.no/studier/emner/matnat/geofag/nedlagte-emner/GEO1030/h17/undervisningsmateriale/oseanografi/kompendium-2016-1.pdf>
2. <https://incois.gov.in/documents/Basics%20of%20Oceanography%20-%20INCOIS%20-%20P%20K%20Bhaskaran.pdf>

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the basics of Ocean	K1
CO2	To Understand the importance of energy source in ocean studies	K2
CO3	Know different tides form oceans	K3
CO4	Understand the descriptive types of ocean	K4
CO5	Understand the importance of oceans in India	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	2	1	1	2	1	1	2	2

3 - Strong, 2 – Medium, 1 – Low

Semester: III	Course Code: 23UGECT04	Hours/Week: 5	Credit: 5
COURSE TITLE: CORE IV - MINING GEOLOGY			

Course Overview:

1. Understanding the importance of accurate sampling in mining processes
2. Exploring various sampling methods for ore analysis.
3. Introduction to different drilling equipment. Exploring drilling methodologies used in mining operations.
This course provides a comprehensive understanding of mining geology, covering essential principles, terminology, drilling methods, explosives, and various mining techniques.
4. It aims to equip learners with the knowledge necessary for successful exploration, extraction, and evaluation of mineral resources.
- 5.

Learning Objectives:

1. Understand the basics components of Structural Geology
2. Know the formations of geological formations
3. Basics of Aerial Photographs
4. Understand the Application of Satellite science
5. Analyze various physiographical features through GIS

Unit - I	Introduction to Mining	09 Hours
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Mining terms and their descriptions.

Sampling - Principles - Types of sampling ,

Collection & preparation of samples.

Drilling: Types of drills and methods of drilling.

Geological logging.

Explosives and Blasting Methods.

Rock excavations.

Assaying and evaluation of ore-bodies

and their extensions-ore reserve estimation

Unit - II	Mining Terminology	09 Hours
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Role of geology in mining industries
 definition of mining terms, shaft, Hanging wall, Adit,
 roof, Drive crosscut, Tunnel, Raise, Winze, Stope, Ventilation, Haulage
 Surface methods of mining,
 Alluvial mining - pan & betea, sluicing
 Hydraulic king, Drift mining and Dredging.
 Opencast mining. Benches, Explosives, working slope

Unit - III	Mining equipments	09 Hours
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Mining equipments - Dragline, Mine machinery-power shovel,
 Bucket wheel excavator, conveyor and spreader Top slicing.
 Sublevel caving and Block caving.
 Coal mining (surface mining) Strip mining and Augering
 Transportation -cleaning - Grading - Shipping.

Unit - IV	Underground mining Methods	09 Hours
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Underground mining.
 Room and pillar method - Longwall method- hydraulicking.
 Mineral Economics and its concept.
 Role of Minerals in National Economy
 Mineral conservation and substitution

Unit - V	Types of mining	09 Hours
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Types of mining - Glory hole, Kaolin mining,
 Granite mining, sand mining, stripping.
 Ground water control
 Power source roofing
 Mining and environment
 Mitigation of mining hazards.
 Factors controlling the choice of various mining methods.

Text Book(s):

1. Curran, P (1988). Principles of remote sensing. Corgman Publishers, London Lillesand, T.M and R.W. Kiefer (2000). Remote sensing and image interpretation.
2. John Wiley & Miller, V.C (1961). Photogeology. McGraw - Hill Publishers, New York
3. Pandey, S.N (1987). Principles and applications of photogeology. Wiley Eastern Ltd., New Delhi
4. Sabins, F.F (1987). Remote sensing principles and interpretation. Freeman Publishers, New York
5. Siegal, B.S and R. Gillespie (1980). Remote sensing in Geology, John Wiley & Sons, New York

Reference Books:

1. Arogyaswamy, R.N.P. Courses in Mining Geology - Oxford &IBH, New Delhi.
2. Thamus, P.J. 1979 An introduction to mining, Methun.
3. Mc Kinstry, H.E 1960 Mining Geology, New york.
4. Allum, J.A.E (1978). Photogeology and regional mapping, Pergamon Press Ltd., Oxford.
5. Anji Reddy, M (2001). Textbook of remote sensing and GIS, BSP PS Publications, New Delhi

Web Resources:

1. <https://www.forgottenbooks.com> > download
2. <https://study.com/academy/lesson/what-is-economic-geology.html>

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Understand the basics components of Structural Geology	K1
CO2	Know the formations of geological formations	K2
CO3	Basics of Aerial Photographs	K3
CO4	Understand the Application of Satellite science	K4
CO5	Analyze various physiographical features through GIS	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: III	Course Code: 23UGECT05	Hours/Week: 5	Credit: 5
COURSE TITLE: CORE V - GEOMORPHOLOGY AND GEOTECTONICS			

Course Overview:

1. In geomorphology, the fluvial cycle involves the development of landforms through running water, including valley formation, river capture, waterfalls, meandering, and the creation of river terraces.
2. Wind and underground water contribute to geological processes, shaping landscapes.
3. The ocean floor's topography is influenced by erosional and depositional features, including coral reefs with diverse types and theories explaining their origin
4. Volcanoes, characterized by structure and types, produce various products and are globally distributed.
5. This overview encompasses the dynamic processes that shape Earth's surface and geological phenomena occurring both above and below the surface.

Learning Objectives:

1. Know the basics of Geotectonics and landforms
2. Understand the importance of various geomorphological agencies.
3. Process of Geomorphological features and creation of landforms
4. Understand and predict Earth's Internal and external processes
5. Predict the future from the past formed features

Unit - I	Introduction of Geomorphology	09 Hours
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Interpretation of fluvial cycle

Landforms developed by running water

Valley development, river capture, waterfalls, meandering, river terraces,

Lakes, their types and deposits.

Geological work of wind and Underground water.

Unit - II	Landforms	09 Hours
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Glaciers – formation, movement, types and landforms due to their erosional and transportational activity.

Topography of ocean floor – erosional and depositional features of oceans

Coral reefs, types, theories for the origin of coral reefs

Submarine Canyons.

Unit - III	Landforms	09 Hours
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Mountains – their kinds, development and important mountain building movements.

Processes of weathering -types and products-

Mass Movements.

Unit - IV	Geotectonics	09 Hours
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Earthquakes – types – seismographs – intensity and Magnitude scales (Richter & Mercalli)

Tsunami - Global Distribution

Volcanoes – structure, types – products

Global Distribution

Unit - V	Geotectonics	09 Hours
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Continental drift – Wegner Concept – various evidences.

Plate tectonics – concept – plate characteristics – larger and smaller plates

Types of plate boundaries – causes and mechanism of plate motions.

Text Book(s):

1. Worcester , P.G., A Text Book of Geomorphology, East West Press Ltd. Delhi.(1960)
2. Sathya Narayanaswami, B.S. Structural Geology. Dhanpat Rai & Sons. New Delhi.(1994)
3. Gokhale, N.W. , Theory of Structural Geology, CBS, Delhi(1995)

4. Davis, G.H, Structural Geology of Rocks and Regions. Elements of Structural geology, Wiley(1985)
5. Ragan D.M., Structural Geology-An Introduction to geometrical Techniques. Wiley. New York(2000)

Reference Books:

1. Hills E.S., Elements of Structural Geology, Chapman &Hall. London(1963)
2. Mahapatra G.B. Textbook of Physical Geology, CBS publications, Delhi(1994).
3. Park, P.G., Foundations of Structural Geology, Blackie. London (1983).
4. Radhakrishnan V, General Geology, V.V.P. Publications, Tuticorin (1996),
5. Bloom A., Principles of Geomorphology (1985).

Web Resources:

1. <http://www.labotka.net>
2. <http://www.patnasciencecollege.org>
3. <https://geomorphology.org.uk>
4. <https://gradeup.co>

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Know the basics of Geotectonics and landforms	K1
CO2	Understand the importance of various geomorphological agencies	K2
CO3	Process of Geomorphological features and creation of landforms	K3
CO4	Understand and predict Earth's Internal and external processes	K4
CO5	To fit the curve using geological data.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3 - Strong, 2 – Medium, 1 – Low

Semester: III	Course Code: 23UGESO02	Hours/Week: 1	Credit:1
COURSE TITLE: SEC IV- PRINCIPLES OF SURVEYING			

Course Overview:

1. In entrepreneurship surveying, principles play a crucial role.
2. The course covers surveying's objectives, uses, classification, and principles.
3. It delves into units of measurement, errors (sources, types, corrections), accuracy, precision, and stages of survey operations.
4. Linear measurement methods, including devices like ranging rods, chains, and tapes, are explored for distance measurement.
5. The course provides a comprehensive overview to equip entrepreneurs with essential surveying skills.

Learning Objectives:

1. To learn about the principles of surveying, sources and errors.
2. To know about the components and procedures of Prismatic Compass and Traverse survey.
3. Know about the leveling procedures, instruments and its applications.
4. Understand the principles, adjustments, methods of Plane Table Survey.
5. To acquire the knowledge about the Total Station Survey and its merits and demerits.

Unit - I	Introduction of Surveying	09 Hours
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Surveying: Introduction – objectives – Uses ,
 Classification –Principle of Surveying
 Units of measurements
 Errors – Sources, Types of errors
 and their corrections – accuracy and precision
 Stages of survey operations
 Methods of Linear Measurement
 Distance measurement devices: Ranging rod, Chain, tape.

Unit - II	Measurement of Angles	09 Hours
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Measurement of Angles and Directions – Definitions ,
 Meridians – Bearings – Magnetic and True bearings – Azimuth.
 Prismatic Compass: Components -Adjustment of the compass: Centering,
 Leveling, and focusing the prism.
 Traverse: Types of the traverse –procedures – Control establishments ,
 Adjustment of closing error.

Unit - III	Surveying	09 Hours
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Leveling and its application: Introduction to Leveling – Methods
 Types of instruments –Description of Dumpy level: Temporary adjustment of level.
 Auto leveling: Types – Parts – Operation – Merits and demerits.

Unit - IV	Surveying	09 Hours
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Table Surveying: Definition - Principles – Accessories
 Temporary adjustments – Setting up the Plane Table
 Methods of Plane table surveying: Radiation, Intersection,
 Traversing & Resection methods.
 Advantages, disadvantages and Errors in Plane Tabling.

Unit - V	Surveying	09 Hours
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Total Station Survey: Introduction – Features: Linear,
 Angle and Height measurements
 Accessories – Setting - up and orientation
 Types of error and error correction
 Advantages and disadvantages of TSS
 Introduction to Drone Survey.

Text Book(s):

1. Novin, C. M. Principles of structural Geology John Willey, New York.
2. Gokhale, N. W. Theory of Structural Geology, CBS Publishers.
3. Billings, M.P. Structural Geology: Prentice Hall, Englewood Clifts, U.S.A

Reference Books:

1. V.V. Belousov - Structural Geology, Moscow
2. P.C. Bedgley - Structural and Tectonic, Principles: Harper & Row, New York
3. E.W. Spencer - An Introduction to structural Geology: Mc Graw Hill, New York.

Web Resources:

1. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000274/M027317/ET/1518524040paper4module_27_etext.pdf
2. <https://sciences.uodiyala.edu.iq/uploads>.

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Gain the knowledge over principles, various errors and types of surveying.	K1
CO2	Ability to know the measurement of angles and direction using Prismatic Compass survey.	K2
CO3	Gaining knowledge about leveling instruments and its applications.	K3
CO4	Complete understating the Plane Table survey.	K4
CO5	Understand the concept of recent techniques of Total Station	K5
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create		

Mapping (COs vs POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	2	2
CO2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	1
CO4	3	3	3	3	3	2	1	1
CO5	3	3	3	3	2	2	2	3

3- Strong, 2 – Medium, 1 – Low

Semester: III	Course Code: 23UGESO05	Hours/Week: 2	Credit: 2
COURSE TITLE: SEC V - GEO HAZARDS			

Course Overview:

1. Geohazards refer to catastrophic geological events such as floods, tsunamis, landslides, earthquakes, volcanic eruptions, and avalanches
2. The study of these natural hazards involves assessing their magnitude, predicting occurrences, and understanding public perception.
3. Laws and regulations play a crucial role in guiding hazard management efforts,
4. Providing an overarching framework for addressing and mitigating these potentially devastating events.
5. The goal is to predict and understand these hazards better, leading to effective hazard management strategies.

Learning Objectives:

1. To explain students about the physical and geological processes causing geo-hazards.
2. To discuss the methods for quantifying geohazards.
3. To understand the possible consequences as well as risk and disaster management.
4. Aware the geological and physical process were to be discussed.
5. Different types of geohazards, disaster prevention and management.

Unit - I	Hazard management	09 Hours
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Natural Hazard – Definition

Earth's processes: catastrophic geological hazards

Study of floods, tsunamis, Landslides, Earthquakes

Volcanism and avalanches – with a view to assess the magnitude of the problem,

Prediction and perception of the hazards.

Laws and regulations towards hazard management.

Unit - II	Seismology	09 Hours
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Earthquakes – Definition – focus – epicenter - seismic waves - intensity and

Magnitude - Richter scales

Scales – Tsunami – Seismograph - seismogram

Seismicity in Indian region

Seismic gaps - mitigation measures and management.

Preparation of seismic hazard map.

Unit - III	Volcano and Mitigation	09 Hours
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Volcanoes-Definition-structure - types–Global distribution,
Mitigation measures and management.
Avalanche –Definition–types–mitigation
Definition- causes - vulnerable zones in India,
Mitigation measures and management
Coastal erosion– its causes-mitigation measures and management.

Unit - IV	Types of Landslides	09 Hours
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Landslides-types-slow flowage, rapid flowage, sliding and
subsidence–causes and mechanism-Vulnerable zones in India
Mitigation measures and management.
Deforestation and land degradation
Cyclone- Definition-causes - vulnerable zones in India,
mitigation measures and management.

Unit - V	Erosion	09 Hours
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Mass movement – factor in influencing slope stability,
types of mass movement – hazards of mass movement,
Strategies for their reduction and the role of geology.
Soil erosion – Soil formation – soil classification,
factor influencing soil erosion – hazards of soil erosion

Text Book(s):

1. Geology, environment, Society K.S. Valdiya (2004) Universities Press (India) Private Limited, Hyderabad, India
2. Coping with natural hazards: Indian context K.S. Valdiya (2004) Orient Longman Private Limited, Hyderabad, India.
3. Engineering and general geology Parbin Singh (2003) S.K. Kataria and sons Delhi India

Reference Books:

1. General Geology V. Radhakrishnan (1996) V.V.P. Publishers, Tuticorin, India.
2. Lundgren (1986). Environment Geology, Rentice Hall Publishers, New Jersey.

Web Resources:

1. https://www.colorado.edu/center/mortenson/sites/default/files/attached-files/geohazards_0.pdf
2. <https://www.eolss.net/sample-chapters/c12/E1-07-01-04.pdf>
3. https://is.muni.cz/el/1431/podzim2011/G5991/CZ010_Intro.pdf

Teaching Methodology: Videos, Audios, PPT, Role Play, Field Visit, Seminar, Chalk & Talk, Lecturing, Case Study, Demonstration, Problem Solving, Group Discussion, Flipped Learning

Learning Outcomes:

Upon successful completion of this course, the student will be able to

COs	Statements	Bloom's Level
CO1	Explain the physical and geological processes causing geohazards such as landslides, floods, tsunamis and earthquakes.	K1
CO2	Describe methods for quantifying hazard for the individual geohazards and factors controlling the irun certainty	K2
CO3	Explain possible consequences of geohazards as well as risk and disaster management.	K3
CO4	Complete a basic hazard assessment for selected geohazards.	K4
CO5	Gain an additional knowledge on possible interactions between geohazards and their consequences	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping (COs vs POs)

	PO1	PO2	PO3	PO4	PO5
CO1	2	1	3	1	3
CO2	2	1	2	3	1
CO3	3	2	2	2	2
CO4	2	2	3	1	2
CO5	3	2	1	2	3

3 - Strong, 2 – Medium, 1 – Low